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Contributors

RICHARD PHILLIPS, Associate Professor in the Department of Agricultural Economics and Rural Sociology of Iowa State College, teaches and conducts research in the marketing of grains and feed.

BENNO K. MILMORE, an epidemiologist, is with the Biometry and Epidemiology Branch, National Cancer Institute, U. S. Public Health Service.

ARTHUR G. CONOVER is Head of the Tobacco Section, Statistical and Historical Research Branch, Agricultural Economics Division, AMS.

FREDERICK D. STOCKER is a member of the Agricultural Finance Section, Production Economics Research Branch, ARS. His work deals with Federal income taxes and their effect on agriculture.

HARRY A. STEELE is Head of the Land and Water Section, Production Economics Branch, ARS.

OTTO RAUCHSCHWALBE does statistical analyses of the sugar program in Commodity Stabilization Service and teaches statistics in the USDA Graduate School. He was formerly with the U. S. Department of Interior.

TRIENAH MEYERS, Head of the Market Surveys Section of the Marketing Research Division of AMS, has worked in the field of household and industrial consumer surveys since joining the former BAE in 1947, and before that did opinion and attitude research at Columbia University, the U. S. Department of Defense, and Bureau of the Census.

SEYMOUR M. SACKRIN, an analytical statistician in the Agricultural Economics Division, AMS, currently is making a study of the demand and price structure for tobacco and tobacco products.

JOSEPH A. BECKER, Director of Statistics of Foreign Agricultural Service, was formerly with the United States Crop Reporting Service, and, before 1944, when he joined FAS, he served as Chairman of the Crop Reporting Board.

DORIS DETRE RAFLER has done economic analyses on problems relating to the Food and Agriculture Organization and other agencies of the United Nations, and has attended meetings of the FAO and the UN Economic and Social Council. Mrs. Rafler is in the Farm Income Branch of the Agricultural Economics Division, AMS.

WILLIAM A. GREEN, Agricultural Economist in the Land and Water Section, Production Economics Research Branch, ARS, for a number of years has been engaged in economic research dealing with river basins, flood control, and other aspects of land and water resource development.

JACKSON V. McELVEEN has been active in appraisal of changes in the overall structure of American agriculture and in developing methods of farm classification and area analysis. He is in the Production, Income, and Cost Section of the Production Economics Research Branch, ARS.

EDITORS: Charles E. Rogers
James P. Cavin

ASSISTANT EDITORS: Raymond P. Christensen
Winn Finner

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AGRICULTURAL ECONOMICS RESEARCH

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Empirical Estimates of Cost Functions for Mixed Feed Mills in the Midwest

By Richard Phillips

Plants in agricultural marketing and processing industries, generally speaking, function in an imperfectly competitive environment and therefore do not necessarily face perfectly elastic supply functions for inputs, or perfectly elastic demand functions for outputs. Relevant coefficients in cost functions of such firms often are dependent on supply as well as production coefficients. Indeed, in contrast to farm production, here the more interesting relationships may arise from price functions rather than production functions. Determination of reliable cost-function estimates under such conditions presents a real challenge to researchers. The accompanying discussion of the estimation of empirical cost functions in such firms is published as journal paper number J–2860 of the Iowa Agricultural Experiment Station, Ames, Iowa, project number 1224.

THE PROBLEM of determining reliable cost functions may be approached either (1) by budgeting from relevant production and price data or (2) by observing cost and volume data from a representative sample of operating firms. Much could be said about the relative merits of each and the criteria for selecting the more efficient for a given situation, but discussion here is limited to the second approach. Suffice it to say that the budget approach has many advantages when the relevant coefficients can be accurately ascertained, especially with the application of linear programming or related techniques.

In estimating costs from observed cost and volume data the typical procedure is to estimate a long-run average cost function by observing, for a single period of time, plants that operate at varying volumes of output. Although the procedure is legitimate if it is based on accurate data from an efficient representative sample of plants in the industry under study, several questions arise as to models and methods of analysis used. A recent study of feed-mixing costs made in the Midwest by Iowa State College under contract with the Agricultural Marketing Service illustrates some of the questions.[1]

Purpose and Design of Study

The Iowa study was designed to obtain information regarding volumes and costs of feed mixing in plants selected to represent a large range in operating tonnage. The population of feed-mixing plants in Iowa and surrounding States was

[1] This article is based on the final unpublished report under the contract, PHILLIPS, RICHARD, HARRINGTON, DAVID N., AND SCOTT, J. T. RELATIONSHIPS BETWEEN VOLUME AND FEED MIXING COSTS IN SELECTED PLANTS IN THE MIDWEST.

For a report of the overall study by the Agricultural Marketing Service, see BRENSIKE, V. JOHN, AND ASKEW, WILLIAM R. COSTS OF OPERATING SELECTED FEED MILLS AS INFLUENCED BY VOLUME, SERVICES AND OTHER FACTORS. Marketing Research Report 79. Agricultural Marketing Service, U. S. Department of Agriculture, Washington, D. C. 1955.

stratified by volume and the several strata were sampled randomly at differential rates to insure an adequate volume distribution in the sample plants. Data were obtained from a total sample of 36 feed-mixing plants.

The study stressed the production and overhead costs of mixing feed. It did not consider such items as costs of ingredients and other raw materials, nor was it concerned with revenues and operating margins in the mixed feeds industry. It was directed toward the operation of feed-mixing *plants*, not toward the size, organization, or functions of the several types and varying sizes of feed *firms*. It was designed to establish the relationship between total mixing volume and cost efficiency in feed mixing, taking into account the degree of capacity utilized. In addition to the data on annual costs, volume, and capacity, monthly figures for production and major operating costs were obtained for many of the plants studied.

Annual Feed-Mixing Volume, Capacity and Cost

A summary of the annual data obtained by personal interview from the 36 sample feed-mixing plants is given in table 1. In this analysis the labor costs of obtaining ingredients, selling finished feeds, and trucking, were excluded also. Thus, the total cost figures include only wages and salaries in feed production and office, and overhead salaries chargeable to production, depreciation, heat, light and power, insurance, maintenance and repairs, interest, rent, and other items of expense. The volume of feed mixed includes the total tonnage of all types of feed mixed at each plant but excludes millfeeds, oil meals, and other ingredients bagged at or handled through the plant but not mixed there. The figures on unused capacity were computed by subtracting the actual production from the possible annual production for each plant if operated at capacity for 52 135-hour weeks.[2] The per ton costs shown in table 1 were obtained by dividing the total cost by the tonnage mixed without regard to unused capacity.

Dependable accuracy in the data for all plants is difficult to achieve in a study of this kind. Even though the information was taken by researchers directly from feed-plant accounts, seven of the plants shown in table 1 were excluded from the analysis because of questionable accuracy in the data. Four of the small plants (numbers 29, 31, 33, and 35) were excluded because the lack of separate accounts for the feed-mixing department meant that the plant managers had to do considerable estimating in order to allocate joint cost

[2] Actual peak performance in the past rather than rated capacity was used to establish the capacity weekly output.

TABLE 1.—*Annual volume and cost of feed mixing and unused capacity, by plants, Iowa and surrounding States*

Number of plant	Feed mixing			Plant capacity	
	Volume mixed	Cost		Unused	Percentage used
		Total	Per ton		
	Tons	*Dollars*	*Dollars*	*Tons*	*Percent*
1	1,877	31,002	16.52	21,523	8.0
2	2,191	21,277	9.71	7,169	23.4
3	6,922	62,097	8.97	58,910	10.5
4	7,856	76,276	9.70	27,244	22.4
5	8,464	107,442	12.69	52,948	13.8
6	10,818	102,691	9.49	82,782	11.6
7	13,122	104,437	7.96	38,046	25.6
8 [1]	14,326	177,988	12.42	NA	NA
9	18,746	95,046	5.07	86,554	17.8
10	17,103	175,000	10.23	26,837	38.9
11	18,999	296,826	15.62	176,001	9.7
12	20,000	189,500	9.47	54,240	35.6
13	23,152	315,118	13.61	223,744	9.4
14	24,848	238,167	9.58	115,552	17.7
15	26,472	253,169	9.56	78,828	25.1
16	35,271	228,524	6.48	1,285	96.5
17	40,729	299,996	7.37	169,871	19.3
18 [1]	63,813	841,647	13.19	12,263	83.9
19	59,833	489,495	8.18	27,454	68.9
20	69,219	441,552	6.38	141,381	32.9
21	66,628	502,412	7.54	58,692	52.3
22	64,783	517,929	7.99	119,453	35.2
23	[2]	[2]	8.30	[2]	43.0
24	[2]	[2]	7.77	[2]	24.2
25	466	7,071	15.17	20,594	2.2
26	555	4,470	8.07	7,141	7.2
27	358	4,651	12.99	6,662	5.1
28	678	9,648	14.23	13,310	4.8
29 [1]	915	5,058	5.53	13,125	6.5
30	1,789	14,828	8.29	29,827	5.7
31 [1]	2,500	12,164	4.87	11,540	17.8
32	554	6,377	11.51	6,466	7.9
33 [1]	1,013	7,346	7.27	13,027	7.2
34	1,500	16,993	11.33	5,520	21.4
35 [1]	1,030	5,355	5.20	30,586	3.3
36 [1]	9,885	39,168	3.96	18,195	35.2
Average	20,762	173,094	8.34	78,163	

[1] Plants excluded for reasons given in text.
[2] Large mills—data used but not shown in order to preserve plant identity.

items. Plant number 8 was excluded because the lack of capacity performance in the past made it difficult to ascertain actual plant capacity. For plant 18, the accounting system did not permit an accurate separation of salaries in sales and other nonproduction activities from those in feed mixing. Plant 36 was excluded because some of the monthly production records had been lost so the manager had to estimate these figures in order to arrive at the annual production figure. The cost, volume, and capacity figures for the remaining 29 plants appeared to be accurate.

Alternative Models for Analysis of Annual Feed Plant Data

It is clear that the determination of the regression of the cost of mixing on some measure of the volume of mixing is appropriate, and likely to be more fruitful, than any tabular analysis of the data in table 1. But even in a problem as simple as this, questions arise as to both the selection of the regression model and the economic interpretation of the statistical results obtained.

Regression of costs on mixing volume.—Perhaps the most common and most simple procedure would be to fit a simple regression of total mixing cost per ton on total tonnage mixed. From the observed data for the 29 plants (table 1), it appears that a reasonably good fit could be obtained in this way. The average cost function would be one that decreases rapidly with increases in output for small outputs and flattens out substantially at the larger outputs. A model of the inverted type $\left[Y=a+b\left(\frac{1}{x}\right)\right]$ or a logarithmic model probably would be most suitable. The resulting simple correlation coefficient probably would be in the neighborhood of 0.6. If a simple regression of total (rather than per unit) mixing cost against mixing tonnage were fitted to the same data, the simple correlation coefficient probably would be about 0.9.

If correctly interpreted, a simple regression model such as this may be useful, as it shows the relationship between output and costs during the period studied. It is not an appropriate estimate of the long-run average cost function. Rather it shows relative per unit costs at various outputs, regardless of the size of plant that produces the output. As it does not consider the position of each plant on its short-run cost function for the period studied, this method provides an approximate estimate of the long-run average cost function only when observed plant size and plant output are perfectly correlated. It correctly estimates the long-run average cost function only when each plant studied is observed at a point on its short-run cost function that is tangent to the long-run average cost function.

It is possible to conceive of instances wherein the simple regression of cost on volume is more appropriate for the purpose at hand than an estimate of the long-run average cost function. But if generalized to periods other than the one studied, the former procedure has serious limitations as the short-run outputs observed are likely to change over time. Notice in table 1 that the plants with the smallest outputs are predominantly those with the smallest percentage use of plant capacity and those with the largest outputs are mostly those with the largest percentage utilization of plant capacity. If this situation were to be reversed in the year following the study, the regression line of cost on volume would be flatter than the one for the period studied. This would be true even though there were no change in the long-run average cost function between the 2 years.

Addition of the capacity variable.—One method of estimating more accurately the long-run average cost function from empirical data, such as those in table 1, is to adjust the observed cost and volume for each plant to full utilization of plant capacity. The simple regression of per unit costs on volume obtained from such adjusted data will provide an estimate of the long-run average cost function.[3] But this procedure requires not only an accurate separation of fixed and variable costs, but also a detailed separation, item by item, of cost elements that vary directly, but not proportionately, with output.[4]

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[3] This estimate of the long-run average cost function will pass through the low points of the short-term average cost functions rather than the true tangency points. The seriousness of this divergence will depend on the shape of both the long-run and the short-run cost functions.

[4] Another disadvantage of this procedure arises when industry acceptance and utilization of the research is desired. This is the general questioning by trade people of adjustments in observed data.

By using a multiple regression model with some measure of capacity utilization as a second independent variable, the same end can be achieved without adjusting the observed data. Such a model considers the maintenance of idle plant capacity as an output that affects production costs apart from the cost of producing the output of the product. It thus has the effect of shifting each plant along its short-run average cost curve to its optimum short-run output in the determination of the long-run regression coefficient of cost on output.[5] The nature of the short-run average cost curve is specified by the multiple regression model itself.

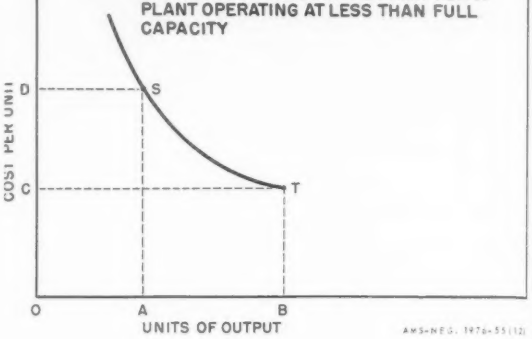
Figure 1 illustrates such a model for an individual plant of OB capacity producing OA units of output. In this instance, the per unit cost incurred, OD, consists of two segments—cost per unit for OA units of maintaining AB units of idle capacity, CD, and cost per unit of output if no idle capacity were maintained, OC. If this plant fell on the regression line in both instances, a simple regression of per unit cost on output would pass through point S. The net regression of per unit cost on output in a multiple regression equation containing an unused capacity variable would pass through point T.

Average versus total cost models.—As in the case of the simple regression of cost on volume, either an average or a total cost equation can be used for the multiple regression model including idle plant capacity. But one must be sure that they are so stated as to be comparable models if they are to result in comparable parameter estimates from the same data. For example, a total-cost model with total cost taken as a function of tons mixed and tons of idle capacity is comparable to an average-cost model with cost per ton taken as a function of tons mixed and the ratio of idle capacity to feed output. It is not comparable to an average-cost model with cost per ton taken as a function of tons mixed and tons of idle capacity.

Regression coefficients obtained by comparable average cost and total cost models fitted to the same data are not directly comparable in any case. If the true average cost curve approaches a straight horizontal line, it is possible to obtain

Figure 1.

ILLUSTRATION OF THE BREAKDOWN OF OBSERVED TOTAL COST PER UNIT FOR A PLANT OPERATING AT LESS THAN FULL CAPACITY



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an R^2 of near 1.0 with a total-cost model and an R^2 of near 0 with a comparable average-cost model fitted to the same observed data. The reverse would be the case if the true total-cost curve approached a straight horizontal line. As the former is more reasonable over any substantial range, and more nearly the usual empirical situation, one can normally expect to obtain higher R^2's with total cost models than with average cost models. Statistical tests of significance need to be interpreted with this in mind.[6]

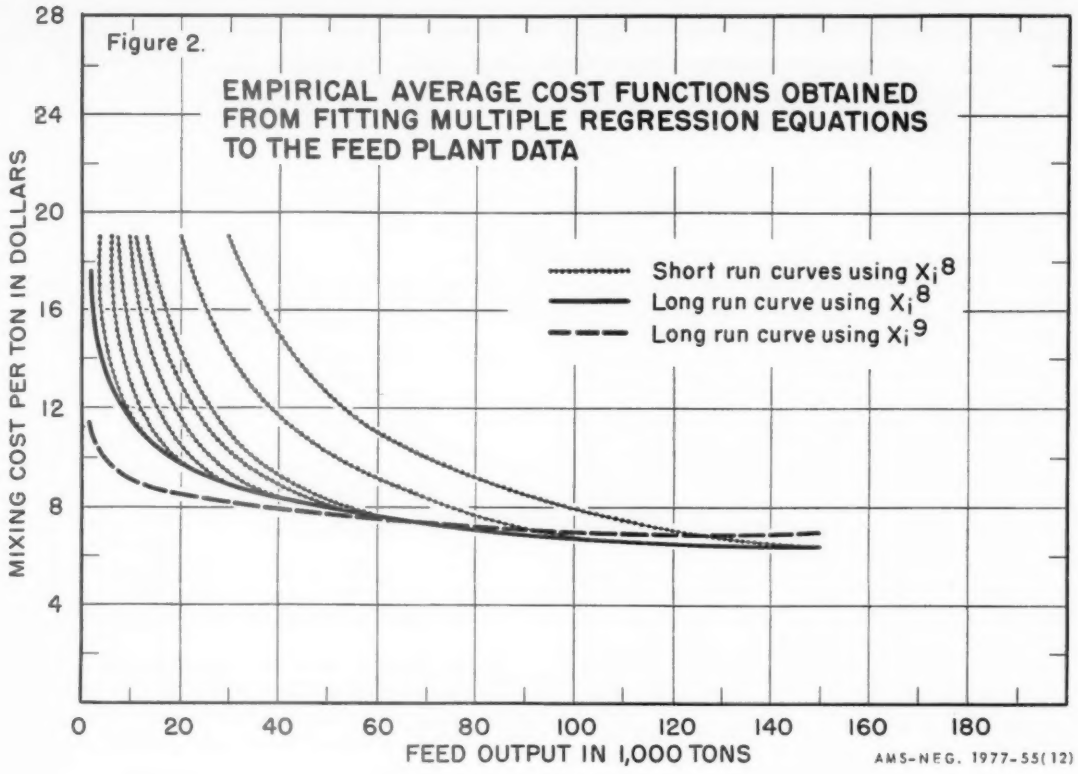
Selection of the total-cost function—the volume variable.—When plotted against feed output on arithmetic paper, the total mixing costs shown in the third column of table 1 show a slight curvature that is characteristic of other cost studies of the agricultural marketing industries at Iowa State College and elsewhere. Total costs of mixing appear to increase at a slightly decreasing rate as output increases.[7] The curvature is so slight that a linear regression of total cost on the output variable will provide a reasonably good fit.

If the solution with this linear model results in a positive Y-intercept of reasonable magnitude, the corresponding average cost function will be nonlinear, decreasing at a diminishing rate as output increases (the apparent relationship in table

[5] The divergence pointed out in footnote 3 applies here as well, but this causes little or no difficulty with the family of cost curves shown in figure 2.

[6] David Harrington plans to develop, more fully, comparisons of average- and total-cost models as applied to costs of grain storage in a thesis problem for the Ph.D. degree at Iowa State College. Mr. Harrington is on the staff at the University of Missouri.

[7] In other words, mixing costs per ton appear to decrease at a diminishing rate as output increases.



1). If the solution results in a negative Y-intercept, however, the corresponding average-cost function increases at the smaller outputs as output increases, possibly well into the relevant output range. Therefore the dependability of the results obtained with such a model depends heavily on the accuracy of the observations at the extreme lower end of the output range.

A total-cost regression equation nonlinear in the volume variable which passes through the origin avoids this difficulty. Such a model is logical because total cost should be zero when both output and unused capacity are zero. But some difficulty is encountered in selecting the final equation most suitable. The apparent curvilinearity is such that an exponent on the volume variable of slightly less than one is required. The precise value of this exponent establishes the curvature not only of the total cost function but of the average cost function as well. Its value is not determined by the usual least-squares solution in fitting the regression equation but must be taken as given, for example, $Y = b_1X_1^{.8} + b_2X_2^{.8}$

In the analysis of data in table 1 by members of the staff of Iowa State College, 4 different exponents on the volume variable were used, 0.5, 0.7, 0.8, and 0.9. The 0.5 exponent resulted in the R^2 of 0.960, the 0.7 exponent in an R^2 of 0.959, the 0.8 exponent in an R^2 of 0.979, and the 0.9 exponent in an R^2 of 0.986. The precise exponent in this instance appears to be somewhere between 0.8 and 0.9.[9] The difference in the curvature of the corresponding long-run average-cost functions when the 0.8 and the 0.9 exponents are used can be seen in figure 2. The average cost function that

[8] Dr. Herman O. Hartley of the Department of Statistics at Iowa State College is currently developing a workable method of solving for the value of the exponent in a comparable model applied to the costs of grain storage.

[9] From the calculations made, one cannot be certain that the exact exponent isn't slightly greater than 0.9 but the range in the R^2's for the four exponents used suggests that it is slightly less.

results from the 0.9 exponent on the volume variable in the total cost function is slightly flatter than the 0.8 exponent over the entire range, and noticeably so at the lower volume range.

Selection of the total cost functions—the capacity variable.—The form of the total cost regression function with respect to the volume variable determines the curvature of the long-run cost function (fig. 2). The form of this total-cost regression function with respect to the capacity variable determines the curvature of the short-run total-cost functions. In the equation used for the analysis of the feed-plant data at Iowa State College, the total cost of mixing was taken to be linearly related to tons of unused plant capacity. The model is thus a simple one with respect to idle capacity. Perhaps it is oversimplified.

This model specifies the family of short-run average total-cost curves shown in figure 2.[10] Each of these curves terminates (or becomes infinitely inelastic) where it intersects the long-run average-cost function at the feed output equal to the plant capacity. They all originate from a common point at infinity on the Y axis. These short-run curves flatten out substantially as feed-mixing capacity increases. So, although cost per ton of unused capacity is constant at all plant capacities, cost per ton of feed mixed for 1 ton of unused capacity decreases as plant capacity (or output) increases.

Logical questions might be raised concerning the nature of the short-run average-cost curves in figure 2 and the use of the model that gives rise to it. Certainly the appearance of these curves differs substantially from that of the usual "envelope" curve. Short-run curves of the same slope for all capacities would require a different multiple regression model, for example, introduction of an interaction term between output and unused capacity. However, except for the fact that the curves in figure 2 do not show a range of costs that increase at an increasing rate beyond the optimum point,[11] they lead to conclusions similar to those drawn from the more usual envelope curves. For example, these curves indicate that the lowest cost for any output can be obtained in the smallest plant capable of producing that output—the short-run curves do not intersect. They also indicate that a large plant can be operated at substantially less than optimum output more efficiently than a very small plant at its optimum output.

[10] The short-run curves shown are those obtained with the regression equation, $Y=b_1X_1^{.8}+b_2X_2$. Those obtained with the equation using $X_1^{.9}$ are very similar. The b_2's were 0.301 and 0.300 respectively.

[11] This situation might be expected, in view of the physical production in mixed-feed manufacture. It is borne out by the average variable cost functions, discussed in a later section of this paper.

Estimates From Analysis of Annual Data

The models used in the analysis of the annual data in table 1 were,

$$(1)\quad Y=b_1X_1^{.5}+b_2X_2,$$
$$(2)\quad Y=b_1X_1^{.7}+b_2X_2,$$
$$(3)\quad Y=b_1X_1^{.8}+b_2X_2,$$

and

$$(4)\quad Y=b_1X_1^{.9}+b_2X_2,$$

where in all cases,

Y = total annual feed-mixing cost
X_1 = annual volume of feed mixed
X_2 = unused mixing capacity on an annual basis

When fitted to data in table 1 for the 29 plants retained by the method of least squares, equations (1) and (2) were discarded because they provided an R^2 of 0.960 and 0.959, respectively. Equation (3) provided the regression equation,

(5) $Y=70.04\,X_1^{.8}+0.301\,X_2$, and an R^2 of 0.979, while equation (4) provided the regression equation,

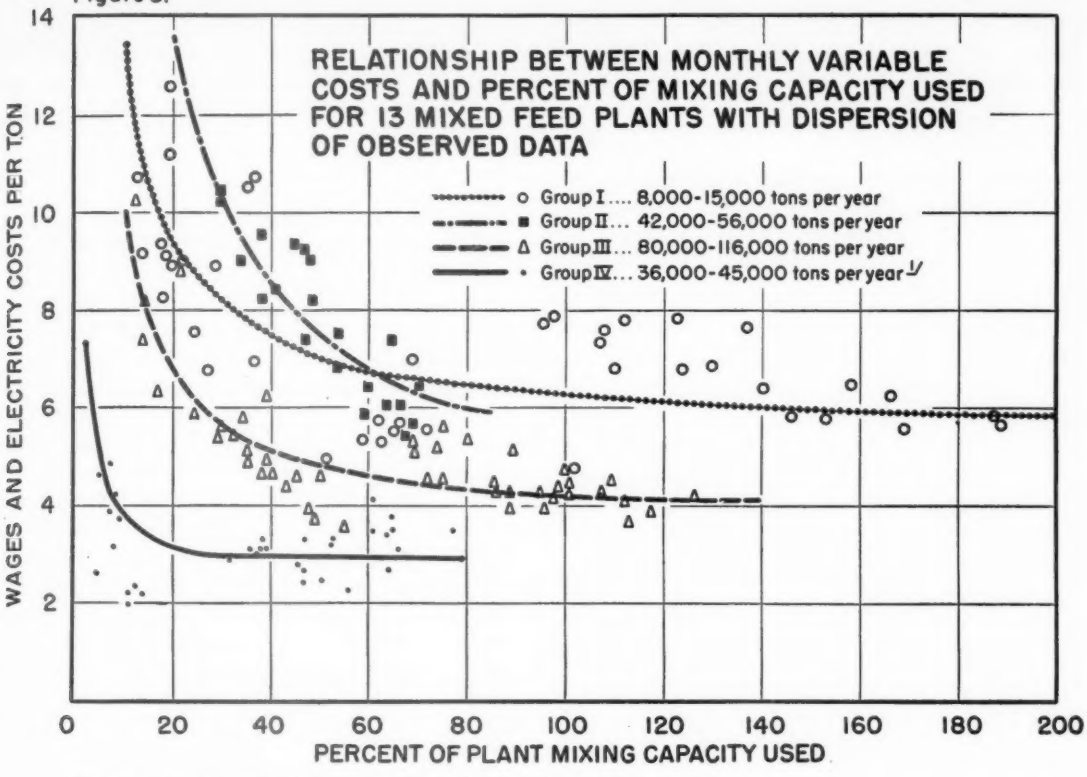
(6) $Y=22.702\,X_1^{.9}+0.30\,X_2$, and an R^2 of 0.986.

The two estimated long-run average feed-mixing cost curves in figure 2 were computed by setting $X_2=0$ in equations (5) and (6), respectively, solving for a series of total costs associated with a given series of values for mixing volume and dividing the result in each case by the mixing volume. The estimated short-run cost functions for the several capacities plotted in figure 2 were computed from equation (5) by calculating the decrease in estimated total cost resulting from a given decrease in X_1 and the corresponding increase in X_2 and dividing the result by the remaining value of X_1 in each case.

Monthly Volumes and Variable Costs

Reliable monthly figures for tonnage of feed mixed and costs of two major variable cost items—production labor and electricity—were obtained

Figure 3.



1/ All three of the plants in this group exhibited a high ratio of fixed to variable costs compared to the other plants studied.

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from 13 of the sample mixed-feed plants visited.[12] For purposes of regression analysis, monthly tonnage figures were stated in terms of percentages of the monthly 54-hour week capacity of each plant. The plants were grouped according to annual capacities. Group I included 4 plants ranging in capacity from 8,000 to 15,000 tons. Group II had 2 plants of 42,000 and 56,000 tons capacity. Group III included 4 plants with capacities ranging from 80,000 to 116,000 tons. In Group IV there were 3 plants ranging in capacity from 36,000 to 45,000 tons. All three of the plants in group IV showed a high ratio of fixed to variable costs as compared with the other plants studied.

Regression equations were fitted to the figures for percentage of monthly capacity utilized and the sum of monthly production labor and electricity costs for each of these four groups. The model used was (7) $Y_a = b_o + b_1 \left(\frac{1}{x}\right)$, where,

Y_a = monthly cost per ton of labor and electricity
X = percentage of monthly capacity used

The resulting equations were, for the 8,000 to 15,000 ton capacities (Group I),

(8) $Y_a = 5.50 + 78.36 \left(\frac{1}{x}\right)$; $r^2 = 0.647$ for 42,000- to 56,000-ton capacities (Group II)

(9) $Y_a = 3.329 + 213.845 \left(\frac{1}{x}\right)$; $r^2 = 0.775$ for 80,000- to 116,000-ton capacities (Group III)

(10) $Y_a = 3.545 + 65.455 \left(\frac{1}{x}\right)$; $r^2 = 0.850$ for low variable cost plants (Group IV)

(11) $Y_a = 2.756 + 8.732 \left(\frac{1}{x}\right)$; $r^2 = 0.445$

[12] Because of their bulkiness, the tables reporting these monthly figures for 13 plants are not reproduced here. The observed monthly data are charted in figure 3.

A pooled simple regression equation was determined from the combined data for the plants in Groups I, II, and III, excluding those in the low variable cost group as follows,

$$(12)\quad Y_a = 4.96 + 66.977\left(\frac{1}{x}\right);\ r^2 = 0.441$$

The homogeneity of regression equations (8), (9), and (10) was tested, with the result,

$$F = \frac{32.67}{2.07} = 15.78,$$

which indicates a significant added reduction from separate regressions. Regression equation (12) was discarded.

The curves shown in figure 3 were computed from regression equations (8), (9), (10), and (11). The points dispersed around each curve represent the actual observations used to compute each of the regression equations. The average variable cost curves associated with the 4 curves in figure 3 are quite comparable to the short-run average total-cost curves shown in figure 2. If the curve for any one of the groups in figure 3 were plotted against output for each plant in the group rather than percentage of mixing capacity used, the result would be a family of average variable cost curves much like the short-run average total cost curves in figure 2. The average variable cost regression equations give support to the selection of the annual model used. Although this results partly from the selection of the independent variable in the average variable-cost model used, apparently it is supported by the monthly data. A comparison of the regression curves in figure 3 for groups I and III (as well as the observed points dispersed around them) indicates a difference primarily in level rather than slope. The curve for group III would have to be much steeper than that for group I in order to provide average variable cost functions of comparable slope for the large and the small plants.[13]

Summary

Data for the feed-mixing plants reported here, together with the models and analysis used, illustrate some possibilities as well as some problems, in fitting empirical cost functions for firms in agricultural marketing industries. A simple regression of cost on output does not provide an appropriate estimate of the long-run total and average cost functions when the plants studied operate at various points on their short-run average cost functions. When actual plant capacity can be measured realistically, the introduction of capacity variable into the model provides one means of adjusting for variations in short-run output.

The nature of the relationship between cost and the capacity variable specifies the characteristics of the family of short-run average total-cost functions for the plants studied. As each plant is observed at only one point on its short-run curve selection of the model is somewhat arbitrary in this respect. When monthly outputs and major variable costs can be observed for the plants studied, regression analysis can be applied to these data as a check on the model used for the long-run analysis.

[13] A given variation in percentage of mixing capacity used, say from 80 to 100, represents a much greater change in output in the case of the curve for group III than in that for group I.

Tobacco Consumption in the United States, 1880 to 1954

By Benno K. Milmore and Arthur G. Conover

The trend of cigarette consumption in the United States in recent years has been the subject of much comment and speculation. Changes in the consumption of cigarettes have been most striking, but interest also attaches to the consumption of other tobacco products. The following paper makes a contribution to our knowledge of tobacco consumption and probably furnishes the best measures of it that can be devised.

ESTIMATES of consumption of cigarettes and other tobacco products given in this article are derived from two sources. One of these is the records of production, imports, and tax-paid and tax-free removal for domestic consumption of tobacco products, as compiled by the Internal Revenue Service, United States Treasury Department. The other source is information on consumption of tobacco products published recently by the Agricultural Marketing Service, United States Department of Agriculture.[1] These data were adjusted to obtain comparable estimates of the consumption of each of the 5 principal classes of these products in the United States during the last 75 years. Table 1 shows these estimates in terms of unstemmed-processing weight of tobacco per person over 14 years of age.

Unstemmed-processing weight represents weight of tobacco before stems are removed. It does not include any nontobacco materials, such as sugar, honey, and licorice, that may be added during manufacturing operations. Farm production and total supplies of tobacco, including stocks, are generally stated in terms of farm-sales weight. The unstemmed-processing weight of tobacco averages about 10 percent less than its equivalent farm-sales weight.

To facilitate conversion of unstemmed-processing weight of tobacco in cigarettes and cigars into numbers of cigarettes and cigars, appropriate conversion factors were used (table 2). Recent changes in the number of cigarettes per pound of tobacco are principally attributable to the increasing popularity of filter tip and of king-size cigarettes. It has been estimated that in 1954 more than 28 percent of domestically consumed cigarettes were king-size, nonfilter tips—an increase of 45 percent since 1952.[1] These estimates also indicated that filter tip cigarettes, both regular and king-size, accounted for about 10 percent of the total domestic consumption—about 7 times as many as in 1952.

Estimates of the unstemmed-processing weights consumed separately as smoking and chewing tobacco are only approximate and mainly reflect their respective proportions on a manufactured-weight basis. Consumption figures given here do not include the home use of natural leaf for chewing and smoking. This indeterminate quantity probably was noteworthy, particularly in tobacco-growing areas, in the earlier years of the period covered, but undoubtedly it dwindled to a minor quantity with the passage of time.

Cigarettes that are represented in the data here given are those produced in manufacturing plants; they do not include roll-your-own cigarettes. Tobacco used in roll-your-own is included in the smoking-tobacco category and is not separately available. In the years 1933–40, consumption of roll-your-own cigarettes was considerably larger than during later years, and probably above the pre-1933–40 period. It is estimated that during 1933–40, the tobacco used in the roll-your-own comprised 46 percent of the smoking-tobacco category but that by 1950–54 this proportion had dropped to around 32 percent.

For the purpose of computing average annual tobacco consumption per person, the tobacco-consuming population is arbitrarily considered as all persons 15 or more years old. Although this appears more realistic than use of the total population, it obviously does not adequately represent the tobacco-consuming segment of the population.

[1] See *The Tobacco Situation*, March 10, 1955, table 3, p. 9.

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TABLE 1.—*Tobacco products, unstemmed-processing weight: Consumption per person over 14 years of age, United States, 1880–1954* [1]

Year	Cigarettes	Cigars	Tobacco		Snuff	Total	Year	Cigarettes	Cigars	Tobacco		Snuff	Total
			Smoking	Chewing						Smoking	Chewing		
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*		*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
1880	.047	1.36	.73	3.15	.12	5.41	1918	1.70	2.26	2.03	2.63	.50	9.12
1881	.053	1.50	.82	3.62	.13	6.12	1919	1.98	2.19	1.70	2.47	.46	8.80
1882	.055	1.60	.83	3.13	.14	5.75	1920	1.89	2.45	1.50	2.36	.47	8.67
1883	.069	1.66	.91	3.80	.15	6.59	1921	2.07	2.00	1.56	2.13	.45	8.21
1884	.085	1.64	.84	3.20	.16	5.93	1922	2.14	2.16	1.67	2.13	.48	8.58
1885	.10	1.61	.94	3.82	.17	6.64	1923	2.51	2.21	1.59	2.19	.48	8.98
1886	.12	1.67	.97	3.73	.17	6.66	1924	2.69	2.06	1.62	1.97	.47	8.81
1887	.14	1.70	1.04	3.88	.20	6.96	1925	2.96	1.99	1.61	1.97	.45	8.98
1888	.16	1.68	.99	3.50	.13	6.46	1926	3.17	1.99	1.53	1.90	.44	9.03
1889	.17	1.69	1.05	4.04	.21	7.16	1927	3.42	1.93	1.42	1.73	.46	8.96
1890	.18	1.78	1.12	3.99	.22	7.29	1928	3.58	1.91	1.34	1.64	.46	8.93
1891	.20	1.83	1.20	4.13	.24	7.60	1929	3.91	1.86	1.38	1.62	.44	9.21
1892	.22	1.86	1.15	4.11	.25	7.59	1930	3.84	1.67	1.44	1.47	.43	8.85
1893	.22	1.72	1.14	3.53	.26	6.87	1931	3.63	1.53	1.59	1.28	.42	8.45
1894	.22	1.56	1.22	3.71	.25	6.96	1932	3.21	1.24	1.73	1.08	.38	7.64
1895	.25	1.56	1.20	3.77	.21	6.99	1933	3.49	1.23	1.69	1.00	.38	7.79
1896	.27	1.51	1.17	3.40	.26	6.61	1934	3.94	1.29	1.71	1.02	.38	8.34
1897	.25	1.60	1.18	3.93	.27	7.23	1935	4.11	1.30	1.52	.91	.37	8.21
1898	.21	1.75	1.20	3.42	.27	6.85	1936	4.61	1.40	1.52	.91	.38	8.82
1899	.17	1.90	1.36	3.49	.28	7.20	1937	4.81	1.40	1.47	.90	.37	8.95
1900	.16	1.99	1.42	3.56	.30	7.43	1938	4.76	1.31	1.51	.80	.37	8.75
1901	.16	2.08	1.50	3.47	.32	7.53	1939	4.95	1.32	1.45	.74	.37	8.83
1902	.18	2.20	1.57	3.41	.33	7.69	1940	5.16	1.36	1.50	.74	.36	9.12
1903	.18	2.29	1.78	3.75	.35	8.35	1941	5.95	1.42	1.33	.71	.37	9.78
1904	.19	2.26	2.00	3.74	.36	8.55	1942	7.01	1.41	1.13	.75	.39	10.69
1905	.19	2.31	2.18	3.56	.37	8.61	1943	7.99	1.28	1.02	.77	.40	11.46
1906	.23	2.40	2.14	3.60	.38	8.75	1944	8.04	1.22	.82	.74	.40	11.22
1907	.26	2.37	2.15	3.51	.37	8.66	1945	9.15	1.26	.96	.68	.41	12.46
1908	.28	2.19	2.12	3.39	.39	8.37	1946	9.24	1.37	.60	.63	.36	12.20
1909	.32	2.20	2.17	3.56	.45	8.70	1947	9.16	1.29	.59	.56	.35	11.95
1910	.41	2.19	2.17	3.35	.47	8.59	1948	9.35	1.31	.58	.52	.36	12.12
1911	.48	2.28	2.20	3.25	.43	8.64	1949	9.33	1.16	.59	.49	.36	11.93
1912	.60	2.27	2.20	3.21	.46	8.74	1950	9.36	1.18	.59	.49	.34	11.96
1913	.71	2.36	2.08	3.06	.47	8.68	1951	9.98	1.19	.53	.45	.33	12.48
1914	.74	2.27	2.06	2.88	.43	8.38	1952	10.41	1.26	.49	.43	.33	12.92
1915	.82	2.17	2.13	2.84	.44	8.40	1953	10.46	1.26	.44	.42	.32	12.90
1916	1.13	2.32	2.05	3.00	.47	8.97	1954 [2]	9.84	1.23	.41	.40	.32	12.20
1917	1.58	2.42	1.96	3.03	.46	9.45							

[1] 1940–54 data include Armed Forces overseas.
[2] Provisional.

Little is known concerning how much of the increase or decrease in consumption of various tobacco products per person over 14 years old is attributable to changes in the proportion of such people who use tobacco rather than to changes in the average quantities consumed by users of tobacco.

Trends Vary by Product

Trends of consumption of tobacco, based on table 1, are portrayed on a semilogarithmic scale in figure 1. The consumption of all tobacco products combined has been considerably more stable than that of some of the individual tobacco products. In 1954 total tobacco consumption per person over 14 years of age was 2.25 times as large as in 1880. During the same period, consumption of cigarettes multiplied 209 times and snuff 2.67 times, whereas consumption of other tobacco products declined. Chewing tobacco decreased the most—the 1954 consumption amounted to only 13 percent of that for 1880. Cigar consumption in 1954 was 90 percent and smoking tobacco 56 percent of corresponding figures in 1880.

Figure 2 shows the average annual consumption per person over 14 years old of the 5 classes of

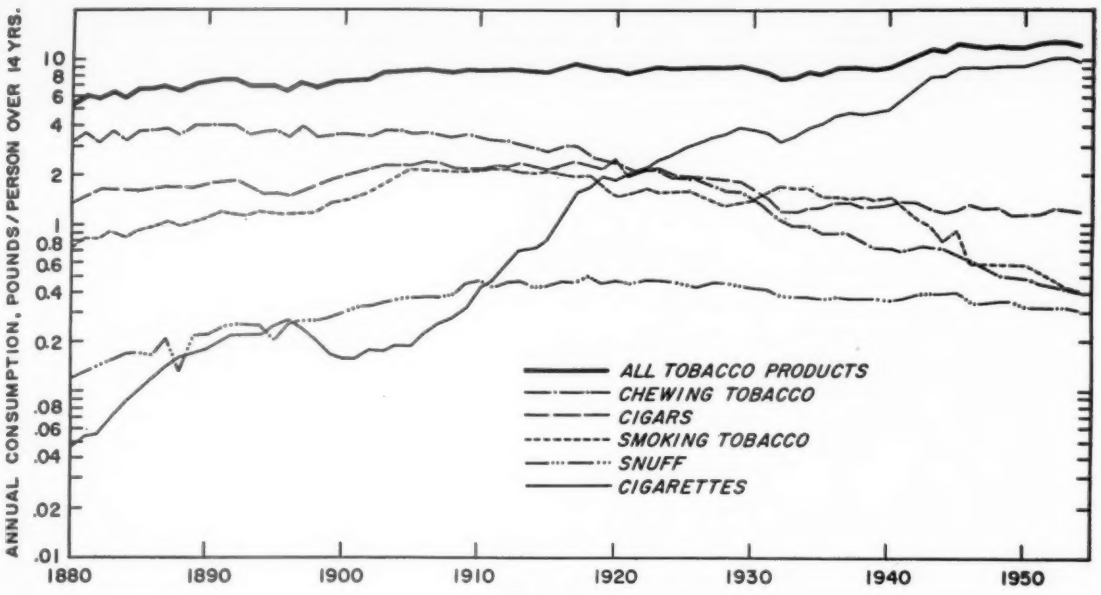


Figure 1

tobacco products during the first, middle, and most recent 5-year periods of the last 75 years. Cigarette consumption in 1880–84 was smaller than that of any other tobacco product; in 1950–54 it was 4 times as large as the sum of all other tobacco products. Snuff is the only other such product for which recent consumption per person was greater than it was 75 years ago. Chewing tobacco was the leading tobacco product of

TABLE 2.—*Number of cigarettes and cigars per pound of tobacco, unstemmed-processing weight; averages 1880–1954, annual 1950–54*

Period	Cigarettes	Cigars [1]
Average:	*Number*	*Number*
1880–99	333	59.9
1900–09	334	63.5
1910–19	332	56.3
1920–29	338	47.3
1930–39	353	43.6
1940–44	348	42.1
1945–49	351	42.1
1950–54 [2]	348	43.0
1950	355	43.0
1951	353	43.7
1952	352	42.8
1953	340	42.8
1954 [2]	339	42.8

[1] Small cigars (weighing not more than 3 pounds per 1,000) represented 6 to 14 percent of all cigars from 1900 to 1929 but had diminished to about 1 percent by 1950 to 1954.

[2] Provisional.

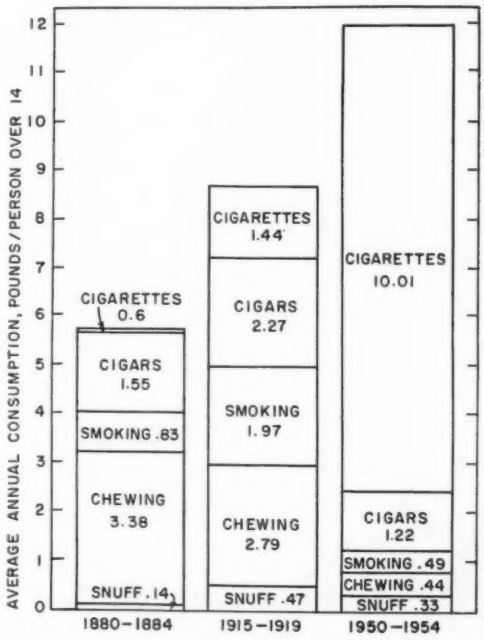


Figure 2

TABLE 3.—*Consumption of each tobacco product expressed as a percentage of total consumption of tobacco, unstemmed-processing weight, averages 1880–1954* [1]

Year	Cigarettes	Cigars	Smoking tobacco	Chewing tobacco	Snuff
Average:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1880–84	1	26	14	56	2
1885–89	2	25	15	56	3
1890–94	3	24	16	53	3
1895–99	3	24	18	52	4
1900–04	2	27	21	45	4
1905–09	3	27	25	41	5
1910–14	7	26	25	37	5
1915–19	16	25	22	31	5
1920–24	26	25	18	25	5
1925–29	38	21	16	20	5
1930–34	44	17	20	14	5
1935–39	53	15	17	10	4
1940–44	65	13	11	7	4
1945–49	76	11	5	5	3
1950–54 [2]	80	10	4	4	3

[1] Because of rounding off, percentages do not always add up to 100.
[2] Provisional.

1880–84; in 1950–54 its consumption outranked only that of snuff. Since 1915–19 the consumption of every tobacco product except cigarettes has declined appreciably—from an aggregate of 7.50 to 2.48 pounds.

The consumption of each tobacco product, expressed as a percentage of total tobacco consumption, is shown in table 3. During the years 1880–84 only 1 percent of this total consumption was in the form of cigarettes; from 1915 to 1919, 16 percent; and from 1950 to 1954, 80 percent. In contrast, the proportions of chewing tobacco declined from 56 percent in the earliest period to 31 percent and 4 percent in the two later periods.

TABLE 4.—*Consumption of cigarettes per person over 14 years of age, United States, 1950–54*

Year	Cigarettes	
	Quantity	Weight [1]
	Number	*Pounds*
1950	3,320	9.36
1951	3,527	9.98
1952	3,661	10.41
1953	3,558	10.46
1954 [2]	3,337	9.84

[1] Unstemmed-processing weight.
[2] Provisional.

In comparison with cigarettes and chewing tobacco, changes in the proportions of other tobacco products were moderate. The percentage of tobacco used as snuff ranged between 2 and 5. That for cigars was fairly stable until 1920–24; since then it has declined from 25 to 10 percent. The percentage consumed as smoking tobacco for pipes and roll-your-own cigarettes gradually increased from 14 in 1880–84 to 25 in 1910–14. Its later decline to 4 in 1950–54 was interrupted during the depression years 1930–34.

Cigarettes Lead in Increases

The consumption of cigarettes per person over 14 years of age was 8.57 pounds greater in 1950–54 than in 1915–19. During the same interval, consumption of all other tobacco products declined 5.02 pounds. Thus 3.55 pounds or 41 percent of the increase in cigarette consumption since World War I may be considered as additional tobacco consumption. The other 59 percent of the increase may be regarded as a shift from other tobacco products to cigarettes.

Table 4 shows that the number of cigarettes consumed per person over 14 years old reached a peak in 1952. But the greatest cigarette consumption in terms of weight of tobacco occurred in 1953. This difference reflects changes in the number of cigarettes produced per pound of tobacco (table 2).

Summary

Estimates of the consumption of each of the 5 principal classes of tobacco products in the United States are here given for the years 1880 to 1954. The annual total tobacco consumption per person over 14 years of age increased from 5.41 to 12.20 pounds. During the same period cigarette consumption increased from 0.047 to 9.84 pounds per person. Except for snuff, consumption of other tobacco products declined. Chewing tobacco was the leading tobacco product in 1880; in 1954 its consumption outranked only that of snuff.

In 1952, 3,661 cigarettes were used per person over 14 years of age, the largest number on record. In terms of quantity of tobacco consumed as cigarettes the peak year was 1953; in that year 10.46 pounds of tobacco per person over 14 were so used. During the years 1880–84 only 1 percent of total tobacco consumption was in the form of

cigarettes; from 1950–54, 80 percent. Since World War I the annual consumption of cigarettes per person over 14 has increased by more than 8 pounds, approximately a 6-fold increase. About 41 percent of this increase may be regarded as additional tobacco consumption, the remaining 59 percent as a shift from other tobacco products to cigarettes.

Disposable Income of Farm People

By Frederick D. Stocker

The United States Department of Agriculture publishes regularly a variety of estimates that measure the overall income position of farming and farm people. During the last decade and a half, however, the tremendous growth in Federal income taxes has clouded the significance of many of the before-tax figures on farmers' incomes. In this paper, the author attempts to measure the income that remains to farm people after payment of income and other personal taxes.

BEFORE WORLD WAR II, income taxes paid to the Federal Government amounted to only a small proportion of total personal income. The amount paid by farmers was so small as to be negligible, and for the population at large it came to only about 1 percent of personal income. But by 1954, this proportion had grown to just under 10 percent. In the industrial sectors of the economy, the rise in Federal income-tax payments has been accompanied by increased emphasis by workers on take-home pay. Economists too have given more attention to disposable income as an indicator of consumer demand and as a standard of well-being.

Although farm income is not in general subject to income-tax withholding, the magnitude of the payments forces many farmers to think and plan in terms of their disposable income. Development of a satisfactory measure of farmers' disposable income, however, has depended on the availability of estimates of the Federal income taxes paid by this group. Recently, estimates of this kind have been developed, covering the period from 1941 to 1955.[1]

The purpose of this paper is to utilize these figures, in combination with estimates of other personal tax and nontax payments of farmers and with published statistics on farm income, to ascertain the disposable income of the farm population. Such estimates offer a more refined measure of the income farm people have available for buying consumer goods or farm equipment, for retiring debt, or for adding to their liquid savings. In this respect, disposable income is a useful indicator of how well off farm people are. It is, moreover, an important figure to those who sell things to farmers—especially such things as farm equipment—because of the great influence disposable income has on the strength of the farmers' demand for the products of industry.

Disposable Income—the Concept

Disposable income, as the term is used in the national income accounts of the Department of Commerce, is found by subtracting personal income taxes and certain other personal tax and nontax payments from personal income. Personal income taxes include, in addition to those paid the Federal Government, the amounts paid to States and to local subdivisions. Other personal tax and nontax payments include State and Federal estate or inheritance taxes, poll taxes, property taxes paid on personal belongings, fines, and miscellaneous charges.[2]

Federal Income Taxes

For the farm population, as for the population at large, Federal income tax payments make up the overwhelming bulk of all personal tax and

[1] See STOCKER, FREDERICK D., THE IMPACT OF FEDERAL INCOME TAXES ON FARM PEOPLE, U. S. Dept. Agr., Agr. Res. Serv., ARS 43–11, July 1955.

[2] Further detail on the items included in the category "personal tax and nontax payments" is given in U. S. DEPARTMENT OF COMMERCE, SURVEY OF CURRENT BUSINESS, NATIONAL INCOME, 1954 EDITION (special supplement), table 8, pp. 170–171.

nontax payments. In calendar year 1954, for the entire population, seven-eighths of these payments were accounted for by Federal income taxes (less refunds). The Federal Government collected about $28.2 billion in personal income taxes in that year. Of this, $1.4 billion came from farm people.

Fluctuations Are Significant

But the full significance of Federal income taxes as a determinant of farmers' disposable income is not revealed in the magnitude of these payments. Their great year-to-year variations give them unique importance. The following tabulation of Federal income taxes paid by farm people reveals a rapid increase during the war years from $15 million in 1941 and a negligible amount before that, to $1,090 million in 1945. Since the end of World War II these payments have fluctuated within wide limits. They reached a high of $1,430 million in 1954 and a low of $825 million in 1950.

Year of payment	Tax [1]	Year of payment	Tax [1]
	Million dollars		*Million dollars*
1941	15	1949	965
1942	85	1950	825
1943	400	1951	865
1944	880	1952	1, 185
1945	1, 090	1953	1, 400
1946	1, 060	1954	1, 430
1947	995	1955	1, 120
1948	1, 365		

[1] Figures rounded to nearest $5 million. Payments primarily on income received in preceding year.

Probably the basic cause of these fluctuations lies in the inherent instability of farm cash incomes. But the variations are amplified by the "built-in flexibility" of the Federal income tax. Because of the graduated rates, variations in income tax payments of such a group as the farm population are more than proportional to the accompanying fluctuations in income. Moreover, because so many farm families receive incomes in the neighborhood of the exemption level, even small changes in farm income may have the effect of adding to or removing from the tax base a large part of the income of the farm population.

This does not take into account the variation in tax payments that can be attributed to statutory changes in the rate schedule of the Federal income tax. During the 15-year period covered in the tabulation, tax rates were increased in 8 years, and reduced in 3 years. The rate schedule that had been applicable to income of the preceding year was retained in only 4 years.

Other Personal Tax and Nontax Payments

Federal income taxes, as noted, account for about seven-eighths of all personal tax and nontax payments by the entire population. The rest is made up of a number of minor items, largest of which are Federal estate and gift taxes and State taxes on personal income. Each of these accounted for about a billion dollars of payments by the population at large in 1954. The items included, and the total paid in 1954, as reported by the Department of Commerce, are shown in the following tabulation:

	Million dollars
Federal:	
Estate and gift taxes	921
Nontaxes [1]	64
State and local:	
Income taxes	1, 098
Death and gift taxes	265
Motor vehicle licenses	445
Property taxes on personal belongings	310
Other taxes [2]	196
Nontaxes [1]	1, 366

[1] Includes certain charges for government products and services, such as tuition and hospital fees; fines and penalties; donations; and special assessments paid by unincorporated business, including home owners.

[2] Consists of poll taxes and miscellaneous licenses and permits.

It is difficult to prepare a precise estimate of the share of each of these that is paid by farm people. But such refined estimates are probably unnecessary. Some of these payments, such as farmers' Federal estate taxes, are probably so small as to be negligible. State income taxes doubtless have a heavy impact on some farm people in certain States, but in the overall view they amount to very little and may also be disregarded. Of the other types of payment, none involves an amount large enough to exceed the margin of error inherent in the estimates of Federal income tax payments of farm people.

How Estimated

It seems best, therefore, to estimate these payments each year as a single package. A convenient method, and one that gives results that appear to be reasonable, is to assume for some recent year that the proportion of total personal tax and nontax payments accounted for by Federal income taxes is the same for the farm population as it is for the entire population. For some components, such as motor vehicle licenses and certain nontaxes, the proportion paid by farmers is probably greater than the corresponding proportion of Federal income taxes. For others, notably Federal estate and gift taxes and State and local income taxes, the proportion is probably smaller. On balance, therefore, the assumption of equality between the proportion of the total paid by farmers and that indicated for Federal income taxes appears to be reasonable.

In 1954, according to Department of Commerce estimates, Federal income taxes accounted for all except 12 percent of the national total of personal tax and nontax payments. The figure for other recent years is almost the same. On the assumption that similar proportions obtain for the personal tax and nontax payments of farm people, a benchmark estimate may be prepared showing the personal tax and nontax payments (other than Federal income taxes) made by farm people in 1954.

It seems undesirable, however, to estimate these "other" payments each year by reference to the corresponding total of farmers' payments in Federal income taxes. The increase in income tax payments since 1941 has been far greater than the increase in "other" payments. Between 1941 and 1954, Federal income tax payments of the farm population increased about 94 times (9,400 percent), and those of the entire population 17 times (1,700 percent). During the same period, "other" personal tax and nontax payments by the entire population increased by only 175 percent.

A better guide to the year-to-year change in other payments by farmers appears to be the change in these payments per capita of the population at large. Starting from the 1954 benchmark, and using the assumption that changes in per capita payments of the farm population are proportional to those of the entire population, we arrive at the estimates shown in column 3 of table 1. Column 4 of this table shows the net disposable income of farm people, after deductions of all personal tax and nontax payments, from 1941 to 1954.

TABLE 1.—*Personal income, personal tax and nontax payments, and disposable income of the farm population, 1941–54*

Year	Net personal income [1]	Federal income tax payments [2]	Other personal tax and nontax payments	Net disposable income
	Million dollars	*Million dollars*	*Million dollars*	*Million dollars*
1941	10,555	15	85	10,455
1942	14,874	85	95	14,694
1943	17,448	400	95	16,953
1944	17,752	880	100	16,772
1945	18,221	1,090	110	17,021
1946	21,021	1,060	115	19,846
1947	22,283	995	125	21,163
1948	24,804	1,365	140	23,299
1949	19,851	965	145	18,741
1950	20,759	825	150	19,784
1951	23,603	865	160	22,578
1952	23,055	1,185	175	21,695
1953	20,833	1,400	180	19,253
1954	19,996	1,430	185	18,381

[1] Source: U. S. Agr. Marketing Serv., *The Farm Income Situation*, No. 155, p. 40.
[2] Based on income of preceding year.

Taxes Offset Farm Income

In 1954, net income of the farm population amounted to $19,996 million.[3] About $1,430 million of this was paid out in Federal income taxes, and about $185 million more went for other personal taxes and nontaxes. Disposable personal income of farm people, therefore, amounted to about $18,381 million in 1954 (table 1).

Table 1 illustrates also the extent to which personal tax and nontax payments, and in particular Federal income taxes, have offset the increase in farm income during the last 14 years. Mainly because of the great increase in Federal income tax payments, the increase in net disposable income of farm people from 1941 to 1954 amounted only to 76 percent. This may be compared with a rise of 89 percent in personal income.

[3] Of this, $12,307 million was received by farm operators from farming, including government payments. Another $1,989 million was received in farm wages by laborers on farms, and $5,700 million came from nonfarm sources. See U. S. Agr. Marketing Serv. *The Farm Income Situation*, No. 155, p. 40.

TABLE 2.—*Disposable income of the farm population and of the entire population, 1941–54*

Year	Farm population			Entire population			Column 3 as a percentage of column 6
	Disposable income	Population	Per capita disposable income	Disposable income	Population	Per capita disposable income	
	Million dollars	*Thousands*	*Dollars*	*Million dollars*	*Thousands*	*Dollars*	*Percent*
1941	10, 455	30, 273	345	92, 982	133, 402	697	49
1942	14, 694	29, 234	503	117, 516	134, 860	871	58
1943	16, 953	26, 681	635	133, 547	136, 739	977	65
1944	16, 772	25, 495	658	146, 761	138, 397	1, 060	62
1945	17, 021	25, 295	673	150, 355	139, 928	1, 075	63
1946	19, 846	26, 483	749	159, 182	141, 389	1, 126	67
1947	21, 163	27, 124	780	169, 016	144, 126	1, 173	66
1948	23, 299	25, 903	899	187, 601	146, 631	1, 279	70
1949	18, 741	25, 954	722	188, 157	149, 188	1, 261	57
1950	19, 784	25, 058	790	206, 130	151, 683	1, 359	58
1951	22, 578	24, 160	935	226, 069	154, 360	1, 465	64
1952	21, 695	24, 283	893	236. 734	157, 028	1, 508	59
1953	19, 253	22, 679	849	250, 371	159, 643	1, 568	54
1954	18, 381	21, 890	840	254, 814	162, 409	1, 569	54

TABLE 3.—*Disposable income of the farm population, in current and constant dollars, 1941–54*

Year	Disposable income (current dollars)	Index of prices paid for farm family living (1947–49=100)	Disposable income (constant dollars)	Farm population (April 1)	Per capita disposable income (constant dollars)
	Million dollars		*Million dollars*	*Thousands*	*Dollars*
1941	10, 455	53	19, 726	30, 273	652
1942	14, 694	61	24, 089	29, 234	824
1943	16, 953	68	24, 931	26, 681	934
1944	16, 772	72	23, 294	25, 495	914
1945	17, 021	75	22, 695	25, 295	897
1946	19, 846	83	23, 911	26, 483	903
1947	21, 163	97	21, 818	27, 124	804
1948	23, 299	103	22, 620	25, 903	873
1949	18, 741	100	18, 741	25, 954	722
1950	19, 784	101	19, 588	25, 058	782
1951	22, 578	110	20, 525	24, 160	850
1952	21, 695	111	19, 545	24, 283	805
1953	19, 253	111	17, 345	22, 679	765
1954	18, 381	112	16, 412	21, 890	750

Some Compensation Evident

By the same process, however, declining farm income is partly compensated for by reduced income tax liabilities. On the basis of income received in 1954, income taxes of farm people are estimated to be $1,120 million in 1955. This represents a drop of some $300 million from the all-time peak reached in 1954, based on taxable income received in 1953. This reduction reflects a decline in income subject to tax and the cut in Federal tax rates effective on 1954 income. The resulting decrease in Federal income taxes is equivalent to an increase of $55 in the yearly disposable income of the average farm family.

Looked at another way, the decline in Federal income taxes paid by farm people in 1955, taken by itself, has the same effect on disposable income as would an increase of 1½ percent in net personal income of farm people from all sources.

Farm Disposable Income Compared With National

Because of the sharp decline in farm population, changes in the income position of the average farm

resident or family over the 14-year period covered in the accompanying tables may differ greatly from those suggested by global figures. As shown in table 2, disposable income per capita of the farm population increased from $345 in 1941 to $840 in 1954, a rise of 143 percent. During the same period, the increase for the entire population was about 125 percent—from $697 to $1,569. But present indications suggest a continued rise during 1955 in the per capita disposable income of the population at large, whereas a drop is anticipated for the farm population. The effect of these changes will probably be to bring disposable income per capita of the farm population to a figure approximately half of the national average.

In table 3, the USDA index of prices paid for farm family living is used to deflate both the aggregate and the per capita amounts of disposable income into dollars of 1947–49 purchasing power. Expressed in these terms, income of the farm population has declined steadily since 1951, and has been below the 1941 level in each year since 1952. The estimate for 1954 shows constant-dollar disposable income of farm people to be about 5 percent below that of 1953 and 17 percent below 1941. On a per capita basis, disposable income in 1954 had a purchasing power well above that of 1941 and slightly greater than 1949, but lower than that of any other year in the period covered.

Economics of Small Watershed Development*

By Harry A. Steele

Passage of the Watershed Protection and Flood Prevention Act has focused attention on the small watershed development program.[1] *The strategic problems involved are those that center around management of land and water and the resulting effects on water runoff, soil erosion, and sedimentation. Significant among these problems are those of water-management, which require action by groups of landowners, communities, and local government. Not all small watersheds have significant interfarm problems. Some have problems that can be solved by individual farmers through land-treatment measures and practices. Floodwater retarding structures, levees, floodways, irrigation structures, drainage installations, gully stabilization, streambank control, highway stabilization, and revegetation of critical runoff and sediment-source areas will be needed for watershed development. In planning and installing these types of measures, assistance is available under the Watershed Protection and Flood Prevention Act. This discussion is concerned with the legislative development of the program, its dependence on economic appraisal, and the economic research needed to make it fully effective.*

ALTHOUGH there was considerable discussion of upstream measures for control of floods before 1900, one of the earliest acts specifically aimed at this purpose was the Weeks Forest Purchase Act, passed in 1911. This act, later amplified by the Clark–McNary Act of 1924, provided for the acquisition of forest lands at the headwaters of streams with a view to controlling runoff. The administration of national forests also implied responsibility for flood control and water conservation.[2] In 1928, the Mississippi Flood Control Act authorized the Secretary of Agriculture to study ways in which forestry might aid control of Mississippi River floods.[3]

*This paper was given in part at a meeting of the Committee on Water Resources Development, Western Agricultural Economics Research Council, Pullman, Wash., June 27–29, 1955.

[1] Public Law 566, 83d Congress, 68 Stat. 666.

[2] GRAY, L. C. REPORT ON FLOOD CONTROL SURVEYS, May 1939. Bur. Agr. Econ. (Unpublished.)

[3] U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF LAND USE COORDINATION, THE LAND IN FLOOD CONTROL, U. S. Dept. Agr. Misc. Pub. 331, 38 pp., illus.

The McSweeney–McNary Act of that year authorized investigations to find ways to prevent erosion and control water runoff. In 1929 the Congress provided for the establishment of field research stations to develop measures for preventing erosion and retarding runoff. Legislation passed in 1933 for relief of unemployment authorized work to prevent forest fires and soil erosion.

In 1935 the Congress took a major step in establishing the Soil Conservation Service, declaring it to be the policy to provide permanently for control and prevention of soil erosion and thereby to preserve natural resources and control floods. In that year also, the Fulmer Act authorized the Secretary of Agriculture to enter into cooperative agreements with the States in a national program for better management of forest lands. The Soil Conservation and Domestic Allotment Act, which became law in 1936, included flood control among its major objectives.

The year 1936 is even better known because it was the year in which the first comprehensive national flood-control act was passed. The 1936 Flood Control Act provided that the U. S. Army Corps of Engineers should make Federal investigations and improvements of rivers and other waterways for flood control, and that the United States Department of Agriculture should make Federal investigations of watersheds and install measures for retardation of runoff and waterflow and for prevention of soil erosion on watersheds. This act designated a list of watersheds that would be surveyed, the Secretary of War to make the flood-control surveys and the Secretary of Agriculture the surveys for the runoff and water retardation. In 1937, the Water Facilities Act authorized the Department of Agriculture to assist individual farmers and groups of farmers to make better use of water in the 17 Western States. Again in 1938, the Secretary of Agriculture was authorized and directed to make surveys and preliminary examinations for flood control in designated watersheds.

Under these authorizations, the Department of Agriculture became a partner with the Corps of Engineers in developing Federal programs for watersheds for the purpose of flood control. From 1937 through 1943, the Department of Agriculture completed (1) preliminary examinations to determine whether detailed surveys were justified for 154 watersheds, covering 1¼ million square miles; (2) detailed surveys including plans for programs for 18 watersheds covering 100,000 square miles and, (3) appraisals of flood damage for 40 additional areas in cooperation with the Corps of Engineers. In addition to completed investigations, approximately 50 examinations and 32 surveys were initiated but were later deferred because of World War II.[4] In 1944, Congress authorized the Department of Agriculture to install works of improvement on 11 watersheds.

After World War II ended, surveys were resumed by the Department of Agriculture. A number begun before the war were completed and new ones were started. From 1945 to 1954, policies relating to watershed management were somewhat unsettled. There were differing viewpoints within the Department, the Bureau of the Budget, and the Congress. One view was that plans should be made for flood control on small or intermediate sized watersheds following the pattern of the 1936 act. Another group wanted to plan on a comprehensive basis for entire river basins, with segments of the work determined by administrative action.

Because of resulting uncertainties, changing policy, and modification of procedures, few surveys were completed and still fewer were sent to Congress during this period. The Committee on Agriculture of the House of Representatives pointed out that in 17 years more than $17 million had been spent on preliminary examinations and sized watersheds following the pattern of the 1936 Flood Control Act. More than 1,000 surveys had been authorized; 58 were completed, and only 11 projects had been authorized by the Congress. No single upstream river-basin project had been completed.[5]

The House Agriculture Committee held a public hearing in August 1950 on the proposed agricultural program for the Missouri Basin, which for the first time outlined the size of the watershed-protection job for a major river basin. Field hearings were held by the House Agricultural Committee in the fall of 1951. These hearings indicated that public support for a watershed program was widespread. The Committee concluded

[4] WOOTEN, H. H. THE AGRICULTURAL FLOOD CONTROL PROGRAM, Jour. Land and Public Utility Econ., February 1946, pp. 35–47.

[5] SOIL CONSERVATION AND WATERSHED PROGRAMS, HR Report No. 1140, 83d Congress, 2d s.

that a serious gap exists between the soil and water conservation program on farms and the large water-control structures in major river developments; that the work in small watersheds could proceed without waiting on major river structures; and that the watershed projects should be cooperative among the Federal Government and States, local governments, and local people. So far as possible, each should bear an equitable portion of the cost.[5]

Watershed Protection and Flood Prevention Act

Several watershed bills were introduced in 1952 and 1953 but no action was taken. In 1953, an amendment to the Appropriation Bill was passed which provided funds for starting pilot projects in 62 watersheds. These projects were designed to demonstrate the watershed program and provision was made for evaluating the results.

In 1954, the Congress passed the Watershed Protection and Flood Prevention Act. The main change from earlier bills is the greater emphasis on State and local responsibility. Federal activities are limited to aiding local organizations in undertaking the work. Although the 1936 Flood Control Act carried a requirement that local interests would furnish rights-of-way, and pay for operation and maintenance, the initiative for undertaking each project and the responsibility for its completion was with the Federal Government.

Thus, we have moved from Federal initiative and responsibility in selection of projects, planning, construction, and maintenance, as set out in the 1936 act, to a situation under the 1954 act in which the major initiative and responsibility for these functions rests with local organizations.[6]

The Watershed Protection and Flood Prevention Act pertains to water-management measures that are beyond the capabilities of individual farmers but that are needed to complement and make more effective the soil- and water-conservation measures on farms and to serve or protect the watershed community. Watershed-protection measures lie between the programs for soil- and water-conservation on farms, and large water-control structures in major river developments. The act places the responsibility for initiating watershed programs on local organizations.[7] Local people must apply for assistance on watershed projects. They must participate in the planning, financing, and construction of the projects, and must arrange for maintaining works of improvement installed under the act. Watershed projects are to be locally sponsored with Federal participation rather than Federal projects with local participation.

Decisions Involved in Developing a Project

A series of decisions is involved in developing a watershed program. In each step in the process those in positions of responsibility must use judgment to arrive at rational decisions. Many factors are taken into account, but throughout the process there is a weighing of the probable costs and returns of the program.

We are concerned here with economic analysis, as it may improve the decision-making process. Following is a partial list of decisions that must be made in developing a watershed project.

The local organization must decide whether the watershed problems are serious enough to warrant preparing an application for a project. They must decide whether a program is likely to be worth while and worth working for. Although precise economic analysis is not practicable at this stage, there must be a weighing of benefits and costs in the minds of those involved. Even at this early stage, the probable incidence of benefits in relation to costs is a factor.

When an application has been prepared by a local organization, the State must study it and decide whether the problem is serious enough to warrant further study and whether a worth while project is possible. The State must also weigh the merits of several applications, if more than one is submitted, and must recommend priorities as to which watershed project should be undertaken first. These decisions at the State level involve the weighing of benefits and costs, along with other factors, to see whether an individual project is worthwhile. It involves also a comparison of the benefits and costs of several projects.

Next in the process of developing a watershed project is a decision by the United States Depart-

[6] YOUNG, GLADWIN E. LOCAL RESPONSIBILITIES FOR WATERSHED PROTECTION PROGRAMS. State Government 27 (12): 255–257, December 1954.

[7] SANDALS, KIRK, AND STEELE, HARRY A., A LAW THAT PUTS RESPONSIBILITY AT HOME, U. S. Dept. Agr. (Water) Yearbook of Agriculture, 1955: 165–170.

ment of Agriculture as to whether to authorize investigation and assistance in planning. At this point, the Department must decide whether it is likely that a worth while project can be developed, whether planning money should be spent on it, and whether local people are likely to meet their responsibilities. Here again, not only benefit cost analysis but the incidence of benefits and costs affect the decision. At this point, precise economic analyses are not available and reliance must be placed on a reconnaissance field examination for this decision.

In preparing a work plan, a group of decisions is involved in formulating the watershed project and in testing the economic justification of its component parts. These decisions rest on economic appraisal. It is this part of the process that is usually thought of as involving benefit cost analysis and it is in this phase that the detailed data necessary for an accurate appraisal are developed. Also at this stage all prior estimates can be checked. The difference between the decisions in this stage of watershed development and other decisions is one of detail rather than of kind.

In the planning process, the major problem is to test the scope and size of the various separable parts of the program, in order to expand each separable part to a point at which its marginal benefits equal its marginal costs.[8] This goal of program formulation is seldom achieved. Failure to achieve it may be explained partly by the administrative, financial, and physical limitations on the number of alternatives that may be tested. The necessary physical surveys that would permit detailed analysis of various alternatives are usually so costly as to be prohibitive.

Here is a problem for economists. Simple, streamlined, and relatively inexpensive methods must be developed for testing alternatives and eliminating all except the most promising. If this were done, detailed analysis of the remaining choices would be possible.

When the plan has been developed and agreement has been reached as to the content, size, and scope of the program and the recommended sharing of costs, the Secretary of Agriculture must decide whether to participate further in the project. At this stage, cost-sharing has probably as much bearing on the decision as has the relationship between benefits and costs.

As pressure develops for funds, watersheds will compete for Federal assistance, and the watershed that makes the largest contribution in relation to its abilities will have a high priority. The Department must base its decision not only on the sharing of the costs of installation but also on the arrangements for maintenance and operation that have been made by the local organization. Careful attention must be given to these arrangements. The Department may no longer be an active participant in the project when the maintenance stage is reached, and these responsibilities will rest solely on the local organization.

Local organizations must decide whether to accept the responsibility of the project. They make the final decision as to whether to sign contracts and agree to undertake the financial responsibility involved. At this point, cost-sharing will become firm. If the cost-sharing is not to their liking, many local organizations may change their minds about undertaking the program. They will measure the costs against their own evaluation of local benefits. Local organizations, at this point, will need a plan for spreading costs among property owners within the organizations. Individual property owners must balance costs against prospective benefits.

The project will be reviewed by other agencies and it must be before the Congress, in session, for 45 days before the Secretary can authorize its undertaking. The Congress will have the opportunity to veto the program if it is found not to be justified or for other reasons.

The Bureau of the Budget and the Congress will review annually the request for appropriations for Federal participation in the program. No doubt they will examine the individual projects as to benefits and costs in deciding the extent to which the Federal Government should participate.

Benefit-Cost Analysis

If benefit-cost analysis is to serve all these purposes, it will be put to a real test. The Department's policy includes this statement: "Works of

[8] Federal Inter-Agency River Basin Committee, Sub-Committee on Benefits and Costs. proposed practices for economic analysis of river basin projects. 85 pp. May 1950. See also, Timmons, John F. economic framework for watershed development. Jour. Farm Econ. 36: 1170–1183, December 1954.

improvement should be based on sound economic analysis. Costs should be less than assured identifiable benefits. Benefits are to be assessed with care and are to be clearly creditable to the improvement. Intangible benefits not subject to evaluation should not be used for economic justification. They may appropriately be used as argument but not as a part of economic analysis." [9]

The Department's handbook [10] for planning watershed programs indicates that benefit-cost analysis is intended to serve several interrelated objectives. These objectives provide a guide for the formulation and selection of sound projects. Application of the provisions of the handbook for benefit cost analysis should show whether benefits are in excess of costs, guide project formulation to maximize net benefits, and aid in selecting the least costly alternative means of meeting project needs. In addition, it should serve as one of the bases for establishing priorities among projects and provide information for determining an equitable sharing of costs.

Evaluation is to be made of all structural measures for which Federal assistance in the cost of installation is provided.

Studies are to be made, as necessary, for formulating projects that are justified on the basis of incremental benefits and costs for each separable segment.

The handbook indicates that land-treatment measures are the basic element of any watershed project and that they shall be considered the initial increment for project formulation. Economic justification of structural measures for inclusion in the project shall be on the basis that the land-treatment measures scheduled for completion in the watershed work plan are installed and effective.

Because Federal assistance to be provided under the act for land-treatment measures is limited to technical assistance required to complete planning and application of such measures during the installation period—and for other reasons—benefit cost analysis is not to be made of land-treatment measures.

[9] Policy of the Secretary of Agriculture for the administration of the Watershed Protection and Flood Prevention Act, March 1955.

[10] U. S. Soil Conservation Service. Interim watershed protection handbook, v. p. 1955. (Processed.)

Measures that require monetary evaluation include: (1) Measures primarily for land stabilization; (2) waterflow-control measures, such as floodwater-retarding structures, channel improvements, levees and dikes, desilting basins, and mechanical field measures installed primarily for flood prevention; and (3) water-management measures, including irrigation, drainage, and water supply.

Benefits that may be included in the benefit-cost analysis are:

1. Reduction in direct and indirect damages from floodwater and sediment.
2. Increases in net income (gross less all associated costs) from changed use of property made possible as a result of reduction in flood hazard.
3. On-site increases in net income from additional production or reduced costs of production, on lands on which measures are installed.
4. Increased net income from additional production, or reduced cost of production, of farm products as a result of drainage and irrigation.
5. Savings in the cost of water treatment resulting from reduction of sediment in industrial, municipal, and domestic water supplies.
6. Other benefits that can be evaluated in monetary terms.

In computing benefits and costs, the time period to be used is 50 years after benefits are available or the useful economic life of the project, whichever is less.

For projects to be installed within 5 years, current prices are to be used for installation costs and projected prices for operation and maintenance costs and benefits.

Interest rates for discounting and computing average annual equivalent values will be 2½ percent for Federal costs and the borrowing rate for local organizations and property owners.

Cost-Sharing

In his policy statement on the act, the Secretary of Agriculture states: "It is the policy that local organizations will be expected to assume that part of the cost of installing works of improvement, exclusive of Federal costs of technical services such as planning, design, supervision, and economic analysis, which is equal to the ratio of local benefits to total benefits and all construction costs for water distribution and other facilities for purposes other than flood prevention and features related thereto. In addition to such costs as accrue to

the Federal Government under the above provisions, the Federal Government may share a portion of the costs otherwise accruing to the local organization when justified in the work plan and the reasons for so doing are set out in detail."

Under the act and policy decisions, local organizations are required to bear the cost of:

1. Land easements and rights-of-way.
2. Capacity in structures for purposes other than flood prevention and features relating thereto.
3. Necessary water rights.
4. Operation and maintenance of works of improvement.
5. Administration of contracts let by local organizations.
6. Installation of land-treatment measures on non-Federal land.
7. That part of construction or installation of structural works of improvement, exclusive of installation services, which is equal to the ratio of local benefits to total benefits.
8. All construction costs for water distribution and other facilities for purposes other than flood prevention and features related thereto.

The cost-sharing arrangements for each watershed will be negotiated within these policies but the general goal will be for the aggregate non-Federal share of the cost of watershed projects throughout the Nation to be at least 50 percent.

Cost-sharing is to be determined on the basis of an allocation of benefits by classes. Class 1 benefits are those that stem from the prevention or reduction of losses. They include floodwater and sediment reduction, prevention of the destruction or impairment of productivity of land and water resources, and the recharging of ground water. Class 2 benefits are those that stem from increased productivity of land and water resources and include increased productivity from irrigation, drainage, agricultural water facilities, and more intensive use of land protected from floods.

Classes 1 and 2 benefits are further subdivided into A and B categories. Benefits in the A category are direct primary benefits which accrue to immediate local beneficiaries. Benefits in the B category are those that accrue to other beneficiaries and the Federal Government. Under current policy, costs allocated to class 1B benefits would be borne by the Federal Government and costs allocated to class 1A and classes 2A and 2B would be borne by local interests.

Provision has been made in the Secretary's policy statement and in the handbook for considering adjustments in costs when this formula results in an inequitable burden on the local organizations. Such adjustment would involve the assumption by the Federal Government of a share of construction costs of structural measures allocable to classes 1A, 2A, and 2B. The local organization might argue that it had already installed part of the program; that costs of land treatment were very large; that the land use adjustments required were prohibitive, or that for many other reasons the Federal Government should bear a larger share of the costs.

It is on the basis of such negotiations that final cost-sharing arrangements will be reached. At this point the Federal Government must decide whether the required Federal investment is justified and the local organization must decide whether the local investment is justified. The local organization has the additional decision as to how it will spread local cost among landowners within its boundaries. Thus, in the end the watershed project must meet the test of economic analysis from both Federal and local viewpoints.

Unsolved Problems of Benefit-Cost Analysis in the Small Watershed Program

The uses of the benefit-cost data enumerated place a heavy burden on appraisal procedures and on those who develop and use them. The major difficulty stems from the need for considering both the national and the local viewpoints. Appraisal procedures for water-resource projects have been developed primarily with a national viewpoint in mind, whereas the arrangements provided in the Watershed Protection Act require both national and local perspectives. The justification of a Federal project requires a welfare-oriented national public viewpoint. The economic justification of a purely local project, on the other hand, is more closely related to what we might call "financial feasibility." The appraisal framework for "partnership projects" should probably reflect a joint application of these differing points of view.

The major questions that benefit-cost appraisals are expected to answer relate to social or public justification. A proposed project with a 1:1 ratio or better is usually regarded as economically desirable. A ratio of less than 1:1 is regarded as undesirable from an economic viewpoint. Available evidence suggests that such appraisals have only limited use for the formulation and design of projects; and even less for the assessment of

charges. Greater emphasis should be placed on the use of appraisal data for project formulation, rather than to indicate overall justification for projects. Under the Watershed Act, there will also be greater need for evaluation data for cost-sharing purposes.

The full impact of these requirements on appraisal techniques is not clear at present, but apparently two generalizations are warranted: (1) New appraisal techniques must shift from present emphasis on total project values to schedules of value which relate both costs and benefits to varying degrees of project scale; and (2) new procedures must be devised for the appraisal of benefits wherein it is possible to identify beneficiaries with a much higher degree of accuracy than is now possible.

With respect to the conflict in viewpoints between the Federal Government and the local organization, three examples may be helpful. From a public viewpoint, the inclusion of secondary benefits in the project analysis usually is not regarded as appropriate. The theory is that the use of capital resources for project purposes would preclude the creation of comparable values in investments foregone. It is apparent that this reasoning does not apply to a community decision, particularly if the invested funds would otherwise have been invested outside the community.

An additional illustration of the difference in viewpoint is the production of a product, the price of which is held above the equilibrium price by Government program or other restrictions. For a public evaluation, equilibrium prices may be approximated at a lower level than is actually expected, thereby reflecting the marginal cost of producing the commodity. To do this in an appraisal that is locally oriented would result in lower returns than realistically might be expected.

With emphasis on local cost-sharing and the prospect that the local organization with the best financial resources will be given high priority, it may be that areas most in need of the programs will not be able to get them.

These examples illustrate the problems involved in the economic appraisal required by this program. The physical and economic analysts involved in the program face a challenging task. They will need assistance from a program of research in improving appraisal techniques and in obtaining more adequate data.

Problems for Further Economic Research

The suggestions for research that follow indicate ways in which the colleges and the Agricultural Research Service might provide such assistance.

Economic planning and program formulation.—The watersheds to be considered under the act cannot be larger than 250,000 acres. The first 62 watersheds approved for planning averaged about 77,000 acres. If costs are to be kept within reason, planning must be efficient. Research is needed on the most efficient methods of measuring benefits and costs, including simple and inexpensive methods that can be used to test various alternatives in program formulation. Economists should work with hydrologists and agronomists in experimental watershed research. Establishment of a North Central Advisory Committee to develop an integrated program of watershed research illustrates the desirable approach.

Watershed input-output data.—More adequate data are needed to guide estimates of the effects of watershed programs. For example, more information is needed on the effects of floodwater and sediment on crops at the different seasons. Data could be obtained by physical scientists and economists working together on integrated experiments.

Responsibilities of local organizations.—The Watershed Act places great responsibility on local organizations. Thorough studies of these responsibilities and of the powers that will be necessary to meet them are needed. Most States do not have enabling legislation for establishing adequate local organizations. Local organizations have had little experience in meeting the management problems that will arise in planning, installing, and maintaining watershed projects. Research should explore the experience of comparable irrigation and drainage districts. With local organizations bearing a large share of the costs, there may be more interest in various kinds of land use regulations to protect works of improvement.

Finally, consideration should be given to the part that the State should play in watershed development. State agencies might play a vital role in directing and assisting local organizations in watershed development.

Book Reviews

Applied General Statistics. Second Edition. By Frederick E. Croxton and Dudley J. Cowden. Prentice-Hall, Inc., New York. 843 pages. 1955. $9.00.

NEW STATISTICAL MATERIAL and methods developed during the last 16 years show their influence on most chapters in this new edition. The authors accepted a prodigious task in attempting to duplicate the smoothness and conservative presentation that are familiar to readers of the 1939 edition. The purpose is the same: "To describe the more commonly used statistical methods and to illustrate their application in many fields." The methods are especially applicable to the social sciences from which most of the examples are drawn. The preface further points out that "nearly all of the examples are new." This is a valuable contribution by itself.

It is stated that "the scope is essentially the same as that of the earlier edition." By simply looking at the table of contents, one cannot appreciate the many improvements introduced by skilful revision, as the chapters and subheadings are much alike. The bright style and interesting presentation of the first edition are retained. The book is highly adaptable for introductory or reference purposes. Greater conciseness in some sections will be welcomed by those who found some of the earlier discussion to be unnecessary.

Readers will find more comprehensive time series analysis and correlation, an improved organization of tests of significance and their interrelationships, a handy symbol vocabulary at the beginning of every chapter, and a larger appendix, including six added tables for tests of significance and a guide to rounding of numbers. New material includes nine important examples of index numbers, more extensive use of transformations in non-linear correlation, expanded analysis of arithmetic means, and a more comprehensive section on analysis of variance.

Improved organization and fewer words account for most of the 115 fewer pages. Among the discontinued subjects are the criterion of likelihood, use of moving averages in time series, use of arithmetic probability paper, some curves with declining absolute growth, a graphic approach to seasonal measurement, methods of forecasting, and various discussions of reliability of statistical measures.

The new edition is no "cookbook" for the novice who is without some mathematical background. The formulas and mechanical adaptations given are no substitute for caution, discretion, and statistical reasoning. Undoubtedly, this book was not intended as a reference guide for determining what constitutes good data, when to use what method of analysis, or how to pursue general computations as given by H. Walker's *Mathematics Essential for Elementary Statistics.* Methods of interpretation based on *a priori* knowledge and comparative analysis are sometimes omitted.

Critical readers may be unhappy about certain minor points that are of interest to those who seek an introduction to advanced methodology. For example, statistical concepts of the sort so clearly explained in Rosander's *Elementary Principles of Statistics* are sometimes obscure, if not absent. The discussion of bias is neither definitive nor helpful in terms of the techniques available in other texts. The need for probability selections is neglected in the discussion of sample types, and the term "statistical method" is confused with the survey method. The chapter on dispersion neglects the concept of degrees of freedom and assumes that we are concerned only with a description of sample variance, even though our prime interest is to estimate the population variance using (N–1) not N. The extrapolation of logistic curves for United States population data will be amusing to those who compare a forecast of 175 million persons for the year 2000 with Census projections that show 336 million.

The first edition is said to have had the widest distribution of any statistical text. The new edition will aid retention of this record. But it is

not a new book. One who owns the old edition should not discard it in favor of the new unless his library is already equipped with such volumes as the third edition of Mills, the third edition of Waugh, the first edition of Rosander, and others that specialize in the field of statistics directly applicable to the work at hand.

Otto Rauchschwalbe

Consumer Behavior, Volume I: *The Dynamics of Consumer Reaction.* Edited by Lincoln Clark. New York University Press. 128 pages. 1955. $5.00.

Consumer Behavior, Volume II: *The Life Cycle and Consumer Behavior.* Edited by Lincoln Clark. New York University Press. 125 pages. 1955. $5.00.

FOR YEARS, social scientists in the universities have conducted research and developed bodies of theory about "human behavior." Often the conclusions were based on small intensive observations adjusted by their personal and ingenious theories of society as a whole. The main purpose of this research is the age-old quest for understanding—knowledge for knowledge's sake.

In another world—the world of business—those interested in the marketing structure have conducted their research and developed theories about "*consumer* behavior." Often their conclusions are based on large-scale observations adjusted by their own ingenuity and experiences in marketing tangible and intangible products. The main purpose of this research is the age-old quest for bigger markets, efficient marketing practices, and greater profit.

Both worlds talked about interdisciplinary research; and in 1952, at the first meeting of the Committee for Research on Consumer Attitudes and Behavior, one of the first real attempts was made to break through the wall between these identical disciplines. They have similar techniques and needs, but they work separately and are too cloaked in layers of semantics to benefit from each other's accomplishments.

During the three conferences, documented in these two volumes, the theorists paraded their models and their knowledge, while those active in "applied" research presented their research designs and their growing body of theory. As one listened to the papers and the discussions that followed, it was evident that both sides were surprised and pleased to find the talent and development of their opposite numbers. Academic research was not just a vague theoretical framework with nonrigorous research in its background. Business research was not simply nose counting at a superficial level.

In the volumes that came out of these conferences, the papers are presented as individual pieces with no attempt to tie them together or to extract a set of principles. But they do make a contribution in preparing for a more definitive handling of these ideas than we had before.

Actually, the papers are based on extremely diverse research projects that vary in scope and in initial objectives, but all of them include some concern with the theme of the individual conference. Unlike the proceedings of most technical conferences, that are characterized by many papers few of which merit an audience, these papers are low in number and high in quality.

For readers who want to learn what is being done about problems of purchase decisions and choice in the research centers, Volume I is recommended for its display of a sampling of good research. Readers interested in viewing consumers in terms of their needs and behavior over the life cycle should read Volume II, which is a compendium of some of the best current thinking of a diversified group of social scientists, each of whom works in a frame of reference that differs slightly from that of any of his colleagues.

Trienah Meyers

The Pricing of Cigarette Tobaccos. By Elmo L. Jackson. University of Florida Press, Gainesville, Fla. 239 pages. 1955. Paper, $3.75; cloth, $4.75.

ECONOMISTS have long regarded the pricing of tobacco on the auction markets as a prime example of oligopsony, that is, few buyers and many sellers. In this study, a sequel to Nicholls' major work on *Price Policies in the Cigarette Industry*, Professor Jackson attempts to find out how concentration of purchases in the hands of a few large buyers has affected auction pricing of flue-cured and burley tobaccos. Central questions that the study seeks to answer are: What are the methods or techniques through which prices of cigarette leaf are arrived at? To what extent, if any, have the large buyers used their power to bring about those prices of leaf which maximize their profits?

Jackson begins his task by examining the nature of tobacco grades and grade demand to show that the various qualities or grades are bought in common by the large buyers. With the pricing problem thus defined as oligopsony rather than monopsony (single buyer and many sellers), he then examines price agreements and price leadership as possible explanations, and concludes that neither of these explains market prices of cigarette leaf.

The reason, according to the author, lies in the heterogeneous nature of tobacco leaf, the bewildering diversity of company grades, and the "subjectivity, inconsistency, and disagreement inherent in tobacco grading," which would make a "comprehensive, old-fashioned conspiracy to set the price of each grade of tobacco . . . very difficult to plan," and "price leadership an unreliable procedure to use in the pricing of leaf tobacco."

To explain how initial prices have developed for cigarette leaf on auction markets, the author advances his own hypothesis. According to this hypothesis, "larger buyers met their problem of initial price uncertainty by (1) concentration of initial sales in a few markets; (2) making careful estimates of the size and nature of the crop and thus reaching rough expectations about opening prices; and (3) resolving the differences in the rough expectations by a process of give and take in the early bidding—a process that may be termed market trial and error." Succeeding chapters consider the effect of the buying policies of the few large buyers on geographical and seasonal price variations, and the extent to which market sharing may have supplemented market trial and error. In examining geographical and seasonal price differences, Jackson found his study complicated by the chief obstacle encountered in tobacco price analysis, which is the multiplicity of, and the range in, tobacco qualities that "add a variable of unknown force to all price data."

The study provides a thorough analysis of an exceedingly complex pricing situation, but the author recognizes its chief limitation. The analysis rests largely on limited detailed price data for the 1930's, before the advent of direct price supports; and on testimony in records of the Government anti-trust suit that was concluded in 1946. He states, "The principal hypothesis, price determination by market trial and error, lacks statistical verification. The hypothesis appears to be consistent with the fragments of available data and the testimony at Lexington, but would this be true if it had been possible to unearth more extensive numerical data?"

Despite the conjectural nature of many of its conclusions, the book is of interest to general students of economics, as well as to those concerned with the tobacco industry. The description of the buying policies of the large buyers of cigarette leaf, although it unavoidably includes much that is surmise and speculation, helps the reader to gain an understanding of the major forces involved in the pricing process.

Seymour M. Sackrin

Economic Development: Principles and Patterns. Edited by Harold F. Williamson and John A. Buttrick. Prentice-Hall, Inc., New York. 576 pages. 1954. $9.00.

A FORTUNATE SELECTION of authors who have varying approaches to a central theme has produced in this collection a thought-provoking source book on the economic development of underdeveloped countries. Assignment of chapter themes minimized overlapping and repetition of subjects; the overlapping that remains appears to be desirable because of the variety of approaches. Successive discussions of the roles of natural resources, of demographic patterns, and of other factors in economic development at the end are illustrated by three selected case studies which give point to the purpose of the book.

What are the fundamental considerations, economic and demographic, that should be considered by those charged with the responsibility of carrying forward any project, large or small, looking to the economic development of the so-called underdeveloped countries? What are the chances that a certain line of attack on a problem will or will not work toward the attainment of its objective? Attempting answers to these questions, each in his own way, the 13 authors contribute guideposts, road signs, and danger signals which those who seek to be guided by economic principles would do well to observe.

In his brief introduction, Harold F. Williamson answers a few questions, which are developed by other contributors to the volume. Joseph L. Fisher treats the role of natural resources, with numerous pointed and easily understood illustrations, and offers "an outline of resource development policy and program." In the chapter on Demographic Patterns, Joseph J. Spengler discusses the major population types found in the world, their "evolving characteristics and prospects," and the part which these play in prospective economic developments.

Parts played by the work force, by the formation of capital and technological change, are treated successively by Charles D. Stewart, John A. Buttrick, and Yale Brozen. They bring out the mutual inter-dependence of the factors of the production that are necessary if a balanced economic development is to be attained.

The discussion of consumption patterns by Joseph P. McKenna treats, among other aspects, of their rigidity in underdeveloped countries in contrast with their greater mobility in economically developed countries where improvement of living standards is reflected in diversity of tastes. In a chapter dealing with the migration of capital, people, and technology, Joseph N. Froomkin summarizes the potentials and limitations of "foreign aid" in assisting economic development. A comparison of Chinese and Western attitudes and reactions to economic impetus, in Francis L. K. Hsu's discussion of cultural factors, leads to a broader understanding of why peoples behave as they do. The role of government in economic development is handled in succinct and positive fashion by Herman Finer.

The case study "Population Growth" by Irene B. Taeuber, illustrated by historical and statistical treatment of economic developments in Japan and Korea, raises questions regarding the possibilities of further industrial expansion in Korea and other underdeveloped countries. In the case study of India, Helen B. Lamb brings out the stark realities of raising standards of living in countries of large population and limited natural resources. On the brighter side, the tale of rapid growth in Mexico in the face of cultural and political obstacles, as told by Henry G. Aubrey, points the way to possibilities when resources, capital, and work force are brought into concerted effort, even though inadequately synchronized.

The role of the editors must not be overlooked. The overall plan is excellent. Though the editors decry any attempt to shape the analyses and conclusions of the authors of the different chapters, such differences as one finds among the contributors appear to be more in emphasis than in principle.

Joseph A. Becker

The State of Food and Agriculture 1955. Food and Agriculture Organization of the United Nations, Rome. 236 pages. 1955. $2.50.

TO MARK the 10th anniversary of its foundation, the Food and Agriculture Organization presents in its annual report for 1955 a statistical and analytical panorama of the decade of agricultural recovery and expansion following the end of World War II.

The first part of the report examines trends of production, consumption and trade in agriculture, fisheries and forestry, and some of the main technological and institutional influences. The report points to a 20-percent increase in production since prewar, the failure of consumption to keep pace with production, the failure to adjust output to shifts in demand, the "stagnation" of world trade in agricultural products, and the consequent accumulation of surpluses. The emergence of these surpluses is taken as one of the two main problems lying ahead; the other is the continued low level of farm income in relation to nonfarm income.

The second part of the report discusses postwar developments and the future outlook for individual commodities.

This report will prove to be a valuable tool for researchers and for those charged with charting future agricultural policies and programs. It may be regarded as the technical counterpart to *The Story of FAO* by Gove Hambidge. The wealth of statistical material relates not only to commodities but to progress in the use and control of water and other physical resources and in the utilization of machinery, improved seed, and other agricultural requisites. Tables and charts generally compare 1954–55 with the prewar (1934–38) and immediate postwar (1946–47) periods, as well as with the years when agricultural production first exceeded the prewar levels. Because of the abnormally low levels of production at the beginning of the postwar decade, the 25-percent increase in output during the intervening 10 years does not constitute a precedent for future growth. Even so, the implicit possibilities for future production increases will give little comfort to the neo-Malthusians.

Technicians may find fault with some aspects of the report. Some may question the practice of measuring progress from 1934–38 when United States data were unusable because of very low production, or from 1946–47 when the world production was even lower than in the selected prewar period. Conclusions with respect to some areas are drawn from data known to be fragmentary or unreliable. Reliance on lower production costs as a major means of stimulating increased consumption and raising farm income is an oversimplification. Then again, the emphasis on present surpluses may seem myopic to countries that are still striving for agricultural development. But on the whole the report is a well-balanced and competent presentation which recognizes that the relief of hunger is a matter of logistics and purchasing power as well as productive effort.

In helping to solve the world's agricultural problems, the Food and Agriculture Organization has accepted as its major role the providing of information and technical assistance. This approach may seem pedestrian to those who still favor ambitious supra-national organizations like the proposed World Food Board or the International Commodity Clearing House. The present Director-General of FAO, P. V. Cardon, having participated in international discussions of such schemes, knows the inherent problems of sovereignty, finance, and administration which make their adoption unlikely.

Doris Detre Rafler

The Flood Control Controversy. By Luna B. Leopold and Thomas Maddox, Jr. The Ronald Press Company, New York. 278 pages. $5.00.

WITH THE RECENT ENACTMENT of the Hope-Aiken Watershed Bill and the current interest in programs for upstream water development, *The Flood Control Controversy* is timely and important to many agricultural workers. This book is concerned with the conflicts between two phases of the Nation's flood-control program. It is the first book to deal com-

prehensively with the question, and it raises serious questions about the upstream approach to flood problems.

The authors are critical of the conventional down-stream approach too, but their primary preoccupation appears to be that of analyzing the conceptual and scientific basis for the land-treatment and upstream engineering approach to the flood problem. Technical procedures of the Corps of Engineers in developing flood-control plans for major flood plains receive scant attention, even though this phase of the Nation's flood-control program is much larger than the "watershed program."

This observation should not detract from the essentially solid achievement of the authors and the sponsoring Conservation Foundation. The volume has much to recommend it to anyone interested in flood control. The physical and engineering aspects are particularly illuminating to the nontechnical reader. The chapter entitled "Engineering Measures" will be of real value to agricultural economists whose major interests are in land and water resources. This chapter provides an excellent simplified discussion of the more important hydrologic relationships in flood control.

Fortunately the authors give a rather convincing demonstration that generally the two approaches to flood control are not physical substitutes for each other. If widely read, *The Flood Control Controversy* can do much to dispel, particularly in rural areas, this currently held belief.

The principal shortcomings of the book probably stem from the clear-cut but questionable impression that the major flood-control issue is the conflict between "the proponents of little dams and proponents of big dams." Despite the seemingly false premise, the authors give explicit recognition to such basic questions as the identification and measurement of the public interest, methods of project evaluation, and cost sharing. Unfortunately, only scant attention is given to institutional obstacles to maximum economic use or control of water. Consequently, with the exception of the Federal organizations, no attention is given to the institutional adjustments that are needed.

The "benefit-cost ratio" is not given prominence in the book, but the authors' viewpoint will interest agricultural economists. They hold that "the benefit-cost ratio is not a measure of the relative desirability of the project, for there is inadequate comparison with other projects for which federal funds might be expended." They point out also that a favorable ratio does not assure that the most economical combination of techniques has been chosen for reducing flood damage. Finally, the authors hold that "more adequate criteria are needed for the evaluation and selection of projects." With respect to establishment of priorities according to economic criteria, they hold that "The suggestion that projects be selected on the basis of a benefit-cost ratio is emphatically rejected. To do so would result in the inflation of benefits and the under-estimation of costs by both agencies." They further explain their position by stating, "our present benefit-cost analyses do not reflect actual and practical values."

As a substitute for benefit-cost evaluation, the authors endorse the wording of a recent House Public Works Committee report as follows: "A more practical measure of the worthiness of an undertaking is the willingness of the immediate beneficiaries to participate in the work by the contribution of funds proportionate to local benefits."

In summarizing their position, Mr. Leopold and Mr. Maddox present a challenge to resource economists. "We are now in position where our ability to design and construct wonderfully complex works of great magnitude far exceeds our ability to evaluate the worth of these works either to individuals, the community, the state, or the nation." Because of this situation, the authors visualize the multiple-purpose approach to water-resource planning as "becoming a hydra-headed monster under whose weight the whole federal program may collapse."

The concluding chapter is entitled "Road Blocks to Progress." In these 16 pages, the authors set forth their solution to the dilemma. They propose that the Congress provide more funds to collect and interpret basic data; that it reexamine and redefine the Federal interest in resource development; and that requirements for local participation in water-resource projects be increased. With respect to organizational adjustments within the Federal Government, the book is essentially negative. Like many others who have struggled with the problem, the authors show considerable frustration. Apparently they believe that modification in the Federal organization would be futile, if not harmful.

This reviewer agrees that many resource problems would not be solved by organizational changes. But certainly some organizational adjustments would permit technicians to gain the comprehensive perspective that is essential for objective evaluation of diverse elements of multiple-purpose projects. The present organization neither provides for nor permits this type of perspective except in isolated interagency committee work.

The basis for many of the conclusions reached is not adequately developed in the body of the book. The emphasis in the basic analysis is on hydrology, engineering, and other physical problems. In contrast, the conclusions and proposed solutions deal principally with complex problems of economics, politics, and institutional arrangements. The lack of supporting analysis in these areas probably constitutes the book's most serious shortcoming.

William A. Green

The Agricultural Regions of the United States. By Ladd Haystead and Gilbert C. Fite. University of Oklahoma Press, Norman, Okla. 228 pages. 1955. $4.00.

NOTHING IS SO TYPICAL of American agriculture as its diversity; nothing so constant as its change. This theme finds realistic presentation in *The Agricultural Regions* as the authors describe an agriculture of today, explore its past, and speculate upon its future growth and direction.

These authors divide the United States into 10 agricultural regions, for the most part groupings of States. They experience the usual difficulties in delineating functional regions of the country along State boundaries—in fact, the title is misleading. The authors do not consistently follow established economic or geographic regions, nor do they seriously attempt to establish more meaningful regions. But the reader does not suffer. More frequently than not, the authors cross their regional lines to follow the geography of major commodity areas. Actually, the generalized groupings of States serve principally as a backdrop as, first from a national and then from a regional perspective, the major shifts in farm size, population, production, and marketing are related to the pressures that brought them about.

The book describes the process of progress and change in agriculture as related to technology and growth in the economy generally. It shows how modern transportation and shifts in consumer demand have altered the competitive positions of regions, how mechanization and a host of other innovations have affected farm size and efficiency, and how farmers have adjusted to these changes.

For statistical reference the book draws heavily on data from the 1950 Census of Agriculture, supplemented by more recent data when available. Results of recent research in the United States Department of Agriculture find ample application. In itself, the collection of data will prove helpful to those interested in regional differences and changes. But the authors have not permitted their data to overweigh their text or to detract from its well-written continuity. Numerous examples and true-life experiences serve to illustrate points and to heighten reader interest.

Some possible conflict of philosophies between the authors may be suspected by those who fail to reconcile the eulogy to agriculture and the strong current of agricultural fundamentalism noticeable in some passages, with the hard facts of economic reality so well presented in others. Description of the lost opportunity and lack of employment alternatives in some of the less prosperous regions of the country appear to contradict such passages as ". . . faithful love affair with the soil . . .", ". . . fulfilment in life only by marriage to the soil . . .", and ". . . no man farms because he has to. . . ." The reader may or may not be in accord with the heavy emphasis placed on conservation of physical resources. With full recognition of the importance, this reviewer cannot agree that it is America's No. 1 agricultural problem.

As the book is nontechnical, specialists may feel that details of their particular fields should have received fuller coverage. But most readers, we believe, will agree with this reviewer in regarding it as worth while for its general coverage of a range of agricultural problems and interests.

Jackson V. McElveen

Selected Recent Research Publications in Agricultural Economics Issued by the United States Department of Agriculture and Cooperatively by the State Colleges [1]

ANDERSON, DALE L., AND SHAFFER, PAUL F. IMPROVED HANDLING OF FROZEN FOODS IN RETAIL STORES. U. S. Dept. Agr. Mktg. Res. Rept. 104, 24 pp., illus. (RMA)

Improved methods of receiving, price-marking, and displaying frozen food, as well as improved equipment, resulted in increases of 31, 36, and 44 percent in labor productivity over conventional methods and equipment. With improved methods the total labor requirements were 3.0 to 3.7 minutes per carton handled.

BIERMAN, RUSSELL W. U. S. MORTGAGED FARMS, 1950. ESTIMATES BY RATIO OF DEBT TO VALUE. U. S. Dept. Agr., Agr. Res. Serv., ARS 43–13, 54 pp., illus. August 1955.

In 1950, nearly 30 percent of all farms in the United States were mortgaged. The average mortgaged farm contained a little more than 200 acres. Its land and buildings were valued at nearly $15,000, and it had a mortgage of a little less than $4,000. These farms were mortgaged for about a fourth of the value of their land and buildings.

BROADBENT, EMER E., AND ZAWADZKI, MICHAL I. EGG SUPPLY AND MARKETING IN THE NORTH CENTRAL REGION. Ill. Agr. Expt. Sta. Bull. 591, 40 pp., illus. (Agr. Expt. Stas. of Ill., Ind., Iowa, Kans., Ky., Mich., Minn., Mo., Nebr., N. Dak., Ohio, S. Dak., and Wis. and USDA cooperating.) (North Central Reg. Pub. 61.) (RMA)

The North Central Region produced more than half the eggs of the United States in 1951. Three-fourths of the eggs sold came from flocks of 100 to 300 hens, and the average size of flock was just over 100. Local produce stations bought about 40 percent of the eggs sold by producers. Prices varied considerably, both by geography and by basis of payment.

BUTLER, CHARLES P. THE BUSINESS SIDE OF PRODUCING BEEF CALVES IN THE PIEDMONT AREA OF SOUTH CAROLINA. S. C. Agr. Expt. Sta. Bull. 426, 50 pp., illus. July 1955. (Agr. Res. Serv. cooperating.)

Many medium-sized farms in the Piedmont are not organized and operated in a way that permits full utilization of their resources. Their operators can add to their returns by improving the farm organization and production practices. Producing beef calves is an alternative that would make fuller and more profitable use of resources but considerable increases in investment and operating capital would be necessary. With cotton at 35 cents a pound and oats at 80 cents a bushel, prices of beef cattle would have to be $15 or more per 100 pounds if the addition of a beef cow-calf enterprise to a representative cotton-small grain system on a medium-sized farm is to be profitable.

DACHTLER, WILLIAM C., MCDONALD, EILEEN M., PHILLIPS, RICHARD, AND HARRINGTON, DAVID N. COSTS OF STORING RESERVE STOCKS OF CORN IN COUNTRY ELEVATORS, AT BIN SITES, AND ON FARMS. U. S. Dept. Agr. Mktg. Res. Rept. 93, 60 pp., illus. June 1955.

Elevator storage costs decrease more rapidly with increasing volume than do bin-site storage costs. Reduction of storage costs by increasing the average length of storage is more pronounced in bin-site storage than in elevator storage. For long storage, bin sites have a cost advantage, but for short periods, annual costs are lower in elevators. Storage on farm may not be economical beyond the first year but good management practices may justify it.

FARSTAD, EDMUND, COX, C. B., KRAMER, R. C., AND PHILLIPS, C. D. RETAILING MEAT IN THE NORTH CENTRAL STATES. Purdue Univ., Agr. Expt. Sta., Sta. Bull. 622, 32 pp., illus. March 1955. (Agr. Expt. Stas. of Ill., Ind., Iowa, Kans., Ky., Mich., Minn., Mo., Nebr., N. Dak., Ohio, S. Dak., and Wis. and USDA cooperating.) (North Central Reg. Pub. 55.)

Seventy-eight percent of the retail meat stores in the North Central States were independent stores, 7 percent were chain stores, and 15 percent were voluntary chains. More than half the stores sold less than $750 of meat a week; less than a tenth had sales of $2,500 or more.

GARLOCK, F. L., JONES, L. A. BIERMAN, R. W., TAYLOR, M. M., AND SCOFIELD, W. H., UNDER THE DIRECTION OF NORMAN J. WALL. THE BALANCE SHEET OF AGRICULTURE—1955. U. S. Dept. Agr., Agr. Inform. Bull. 145, 30 pp., illus. August 1955.

This is the 11th in a series of annual reports that carry forward the comparative balance sheet of agriculture first prepared for 1940. In 1954, farm assets rose slightly after declining in 1952 and 1953. On January 1, 1955, the value of such assets was $163.1 billion.

GARROTT, WILLIAM N. THE COMMERCIAL POTATO PEELING INDUSTRY. A SURVEY. U. S. Dept. Agr. Mktg. Res. Rept. 105, 13 pp., illus. (RMA)

Three methods of peeling potatoes were used by the plants studied: (1) Abrasive, (2) caustic, and (3) steam. Packages ranged from 12 ounces to 60 pounds capacity. Most of the containers were polyethylene bags, or paper bags that had been treated or that enclosed some impervious liner. Peeling losses varied widely. Losses from peeling with cautic solutions ranged from 5 to 28 percent; from abrasive peelers, 10 to 48 percent.

[1] Processed reports are indicated as such. All others are printed. State publications may be obtained from the issuing agencies of the respective States.

GERHARDT, FISK. USE OF FILM BOX LINERS TO EXTEND STORAGE LIFE OF PEARS AND APPLES. U. S. Dept. Agr. Cir. 965, 28 pp., illus. April 1955.

The marketing season of certain varieties of pears and Golden Delicious apples can be extended by using film box liners. Appearance, storage life, and dessert quality are maintained better by packing the fruit in films. Sealed liners are used for pears and unsealed ones for apples.

GOLDSBOROUGH, GEORGE H., AND ANDERSON, KENNETH E. POSSIBILITIES FOR EXPANDING THE MARKET FOR SUGARCANE BAGASSE. U. S. Dept. Agr. Mktg. Res. Rept. 95, 83 pp., illus. October 1955. (RMA)

Although bagasse has physical characteristics making it suitable for use in commercial products, only about 10 percent is being used commercially. This report evaluates the possibilities of further expanding the market for present and possible bagasse products.

GREAT PLAINS AGRICULTURAL COUNCIL, COMMITTEE ON TENURE, CREDIT, AND LAND VALUES, AND THE FARM FOUNDATION. CONFERENCE ON INTERMEDIATE CREDIT FOR AGRICULTURE, FORT COLLINS, COLORADO, JULY 19-21, 1954. PROCEEDINGS. 81 pp. 1955. (Great Plains Counc. Pub. 12.) (Processed.)

The general emphasis of the conference was on the need for intermediate-term credit, problems involved in the extension of intermediate credit, and opportunities for making intermediate credit available to farmers and ranchers under terms that would best satisfy their needs.

HARRIS, ROLAND G., AND LEE, W. A. EFFECTS OF METHODS OF PACKAGING APPLES ON COSTS AND RETURNS TO PENNSYLVANIA GROWERS, 1954. Pa. Agr. Expt. Sta. Progress Rept. 141, 6 pp., illus. (AMS cooperating.)

Purpose of the study was to develop cost and return information that would assist apple growers in choosing from among alternatives the most profitable apple-packing practices. Packing costs were lowest for the jumble pack in re-used field crates; most expensive, hand-bagged nine 5-pound mesh bags in a master carton.

HENDRICKSON, CLARENCE I. THE AUCTION MARKETING OF FLUE-CURED TOBACCO. A PRELIMINARY APPRAISAL. U. S. Dept. Agr. Mktg. Res. Rept. 101, 54 pp., illus.

Savings of more than 5 million dollars annually are possible by improving the tobacco auction system and reducing costs. These savings were found possible even though costs to growers selling tobacco at auction are not large and the system is generally satisfactory. The margin taken at the auction market is about 4 percent of the grower's returns.

JOHNSON, GLENN L., AND HARDIN, LOWELL S. ECONOMICS OF FORAGE EVALUATION. Indiana (Purdue) Agr. Expt. Sta. Bull. 623, 20 pp., illus. April 1955. (Agr. Expt. Stas. of Ill., Iowa, Kans, Ky., Mich., Minn., Mo., Nebr., N. Dak., Ohio, S. Dak., Wis.; U. S. Dept. Agr., and Farm Foundation cooperating.) (North Central Reg. Pub. 48.)

Develops a framework for economic evaluation of forage which suggests that the value be: (1) Not less than the highest net value realizable by disposal—salvage value; (2) not more than cost of acquiring by the most economical means available additional forage units or their equivalent—acquisition cost; (3) the value through use—marginal value product—if this value falls between the limits of 1 and 2 above.

LEWIS, WILLIAM E. TEMPERATURES OF PRODUCE IN RETAIL-STORE TYPE DISPLAY CASES. U. S. Dept. Agr., Agr. Mktg. Serv., AMS–69, 16 pp., illus.

Temperatures of produce displayed continuously without refrigeration averaged 70° F., or 6 degrees below the display-room air temperature. Temperature differences between top and bottom layers were negligible. Produce displayed without refrigeration during the day and stored overnight in 32° and 40° F. "walk-in" coolers averaged 46° and 51°, respectively, for a 24-hour period. Temperatures in top and bottom layers were approximately the same. Three other methods of display were studied.

MCLURE, JOE H. PRICE QUOTATIONS FOR EVEN-RUNNING LOTS OF COTTON. U. S. Dept. Agr., Agr. Mktg. Serv., AMS–75, 19 pp., illus.

Purpose of study was to measure the extent to which the Department's cotton price quotations for even-running lots of cotton delivered to Group 201 mill points conformed to actual prices paid by cotton mills and to inquire into possibilities of improving the quotations to reflect more accurately the actual prices paid by mills.

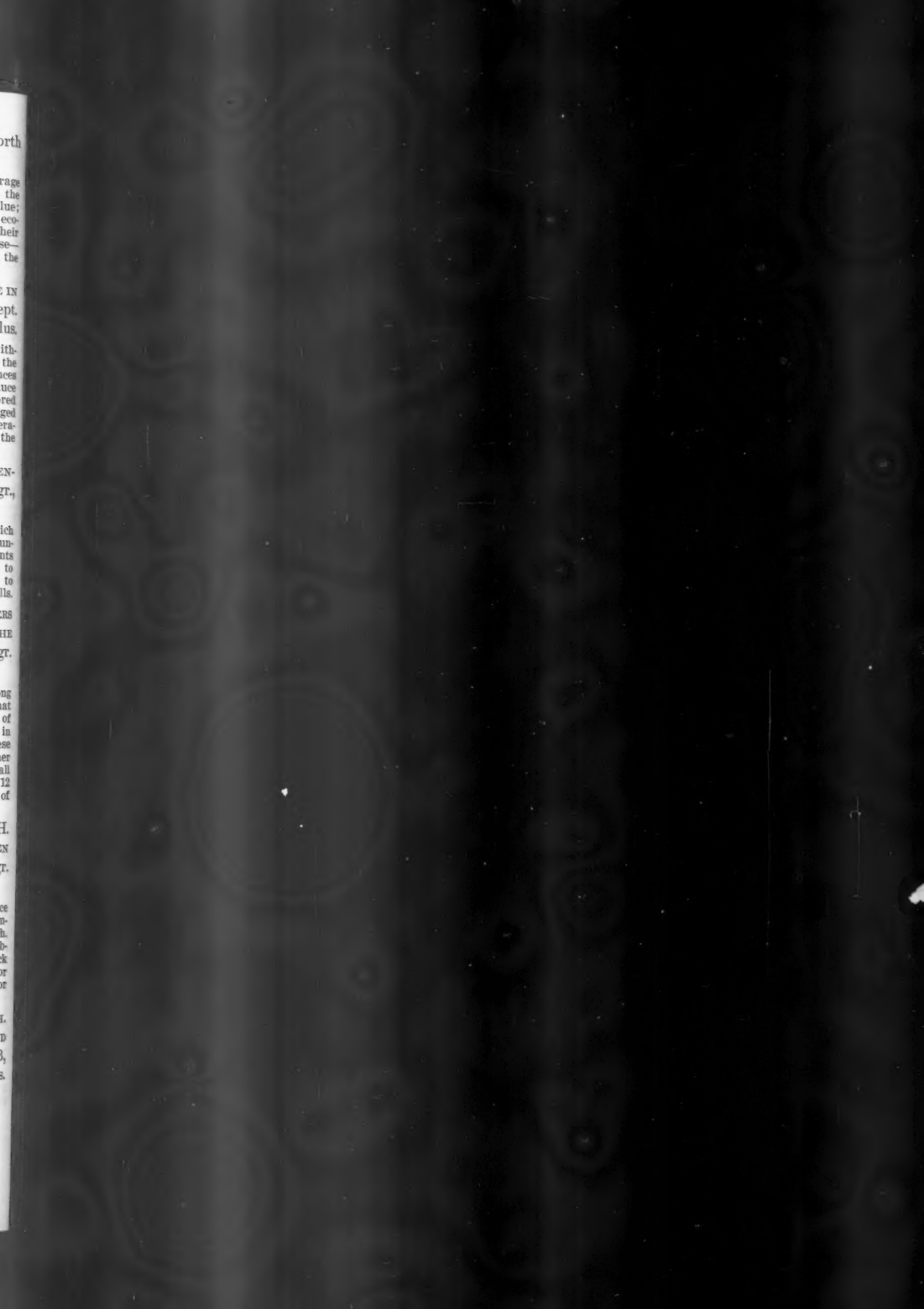
METZLER, WILLIAM H. MIGRATORY FARM WORKERS IN THE ATLANTIC COAST STREAM. A STUDY IN THE BELLE GLADE AREA OF FLORIDA. U. S. Dept. Agr. Cir. 966, 79 pp., illus. January 1955.

Movement of workers from harvest to harvest, along the Atlantic Coast, has been more systematized than that of workers in other migratory labor areas. A study of employment and systematized movement of workers in the Atlantic coast stream, disclosed that most of these migrants came originally from Southeastern States other than Florida, were comparatively young, with small households, and were predominantly rural. In the 12 months before the interviews, they averaged 182 days of employment. Earnings per worker averaged $908.

MIXON, JAMES A., AND ALLEGRI, THEODORE H. SOME IMPROVED METHODS OF HANDLING FROZEN FOOD IN WHOLESALE PLANTS. U. S. Dept. Agr. Mktg. Res. Rept. 107, 44 pp., illus. (RMA)

Some wholesale frozen food distributors can reduce their handling costs 15 to 28 percent by adopting improved methods developed through marketing research. In a plant handling 2,000 cases of frozen food daily, substituting a power conveyor and straddle-type fork truck operation for a 4-wheel hand truck and roller conveyor system resulted in a saving of about 9 cents an order, or 15 percent of the cost of the former method.

MOORE, E. HOWARD, AND BARLOWE, RALEIGH. EFFECTS OF SUBURBANIZATION UPON RURAL LAND USE. Mich. Agr. Expt. Sta. Tech. Bull. 253, 36 pp., illus. September 1955. (Agr. Res. Serv. cooperating.)



Reports a study of the effects of suburbanization on rural land use patterns, property values, and local attitudes toward community services, in two segments of the suburban area that surrounds Lansing, Mich.

North Central Farm Management Research Committee, Subcommittee on Economics of Fertilizer Use. Profitable use of fertilizer in the Midwest. Wis. Agr. Expt. Sta. Bull. 508, 38 pp., illus. December 1954. (Agr. Expt. Stas. of Ill., Ind., Iowa, Kans., Ky., Mich., Minn., Mo., Nebr., N. Dak., Ohio, S. Dak.; Agr. Res. Serv., U. S. D. A., and Farm Foundation cooperating.) (North Central Reg. Pub. 54.)

Farmers need more localized testing of soil fertility and response of crops to varying rates of application of fertilizer. Then the additional yields associated with larger rates of application need to be translated into added dollars of net returns from the increased use of fertilizer under different price and cost conditions as outlined here.

Peters, C. W. Costs of marketing Carolina peaches in 1954. U. S. Dept. Agr. Mktg. Res. Rept. 103, 22 pp., illus. (RMA)

Peach-packing operations were studied in 14 plants in North and South Carolina. Major emphasis was on packing costs, but transportation and selling charges were also studied.

Purcell, Joseph C. Prospective demand for meat and livestock in the South. U. S. Dept. Agr. Mktg. Res. Rept. 99, 78 pp., illus.

Per capita consumption of meat in the South is expected to increase about 28 percent by 1975. Under conditions of full employment this would mean a rise from an estimated 122 pounds in 1950 to 156 pounds in 1975. Aggregate demand for meat in the South is expected to rise from an estimated 3.8 billion pounds in 1950 to 6.6 billion pounds by 1975.

Purcell, J. C., and Penny, N. M. Cost of processing and distributing milk in the South. Southern Cooperative Series, Bull. 45, 40 pp., illus. June 1955. (RMA)

Analyses costs of processing milk in 16 fluid milk plants, and, in a more limited way, procurement and distribution costs in the same plants.

Richey, Perry S., Johnson, Thew D., Cotner, J. B., and Faison, O. M. Grain marketing facilities in the coastal plains area of North Carolina. U. S. Dept. Agr. Mktg. Res. Rept. 100, 39 pp., illus. August 1955. (N. C. Dept. Agr. and Agr. Mktg. Serv. cooperating.) (RMA)

Corn is stored on farms under conditions that promote rapid infestation and damage by insects and damage by moisture in wet harvest years. Storage space is available to care properly for 5 million bushels, leaving 80 million bushels stored in facilities that do not protect the corn from serious damage. Efficiency of off-farm facilities for handling grain has increased greatly since 1948. Six locations for low-cost grain assembly and shipping elevators are suggested.

Rygg, G. L., and Getty, M. R. Seasonal changes in Arizona and California grapefruit. U. S. Dept. Agr. Tech. Bull. 1130, 44 pp., illus.

Gives results of research on seasonal changes in Marsh (seedless) grapefruit.

Smith, Hugh M., Clement, Wendell E., Hoofnagle, William S. Merchandising winter pears in retail food stores. U. S. Dept. Agr. Mktg. Res. Rept. 102, 17 pp., illus. September 1955. (RMA)

A test of four methods of displaying winter pears indicated that retailers can stimulate sales by displaying combinations of medium-sized and large pears and medium-sized and small pears. Sales may be increased when displays include pears both in packages and in bulk.

Stocker, Frederick D. The impact of federal income taxes on farm people. U. S. Dept. Agr., Agr. Res. Serv., ARS 43-11, 32 pp., illus. July 1955.

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